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Journal of Electricity

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IN THE ELEVEN WESTERN STATES

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The Journal of Electricity is sharing in this task, sending its editors into every section of the eleven Western states to interview and gather data to be incorporated in this nation-wide survey. The results of these findings, particularly as applying to Western conditions, will be detailed in forthcoming issues of the Journal for the benefit of its readers. From preliminary reports this work promises to be one of the year's most valuable contributions to the knowledge of the electrical industry.

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EDITORIAL

San Joaquin-Great Western Tie-Line Means Much to Industry

SATURDAY, August 14, marked another milestone in the progress of the electrical industry of California for on that day the Wilson substation as the southern terminus of the 220-kv. tie-line connecting the systems of the Great Western Power Company and the San Joaquin Light & Power Corporation was dedicated with appropriate ceremonies. With the completion of the line one of the greatest steps forward in the electrical development of the state has become a reality. Not only does the line interconnect the systems of two of the largest operating companies on the Pacific Coast but it provides ample facilities for the interchange of large blocks of power between any of the utilities from the Mexican border to southern Oregon.

With its extensive hydroelectric development and widespread transmission systems California was one of the first states to realize the common advantages of interconnection between its power systems. In periods of emergency such as have been occasioned by extreme drought or by breakdown or by increase of demand beyond the capacity of an individual company to serve, system tie-ins have made possible the interchange of moderate blocks of power from one end of the state to the other. Because of their emergency nature these interconnections have been somewhat limited as to capacity. The new tie-line, however, can be regarded as the first real link in a transportation system bus for power interchange that will meet most future demands.

H. P. Wilson, the man who projected the line and after whom the substation was named, describes its significance in the following statement:

"Primarily we are providing for California growth. We are also keeping in line with modern electrical development, which seeks constantly for economies and improved service which may benefit the consumer. The tying together of these two systems will make it possible for us to store water in Lake Almanor which would otherwise go to waste. When this water is coming into Lake Almanor the Great Western will depend for much of its power upon the San Joaquin supply. When Lake Almanor is full the San Joaquin reservoirs may be low, and then the process will be reversed and San Joaquin will be supplied substantially from the Great Western system. This conservation of water resources will mean economical power production the year around. It will obviate the necessity of continuous operation of steam plants and thus effect a big saving in both natural gas and oil, which are used as fuel. It will postpone for a time too the necessity of increased plant capacity and will also make it possible to effect additional economies when such plants are built, as a plant can be built on one system which will adequately take care of the growth of two systems.

"The tie line places the standby service of each system at the disposal of the other. It also establishes an effective insurance factor in the operation of both systems in case of a heavy breakdown that might put a power plant or a transmission line out of business. Obviously this conservation of floodwaters and the use of generating and transmitting facilities in common reduces the amount of investment in such facilities on both systems as against what each would have had to invest otherwise. Ultimately this will mean a reduction of cost of service to the consumer."

While it was built primarily to bring about an improved load factor over the two systems and to effect a happy combination between the peak demands of industry in the territory of the Great Western and agriculture in the territory of the San Joaquin, it has a significance that transcends the mere physical interconnection between the two systems. Only the future will show what part it will play in the power development of the state as a whole.

When "Profits" Are Really Losses

FOLLOWING the issuance of the annual report of Financial Transactions for California Municipalities and Counties, issued by Ray L. Riley, State Controller, for the year 1925, certain newspaper advocates of government ownership of public utilities seem to derive a great deal of satisfaction from data published therein with particular reference to the operation of electric light plants. According to editorial comment in the newspapers that may be classed under this category, the gross revenue from twenty-two municipal electric light and power plants in California, quoting from Mr. Riley's report, is placed at $12,986,080.33; the total expenses at $9,320,000.18. What could be more simple therefore than to deduct the latter amount from the former and show a clear profit of $3,666,080.15, which according to the newspaper reports indicates a net profit no less than 28.3 per cent. An altogether delightful state of affairs, if true.

A scrutiny of Mr. Riley's report, however, and an attempt to reconcile these figures with what Mr. Riley actually does say is an interesting example of the misleading qualities of half truths. The re-

port discloses that in addition to the $9,000,000 and some odd dollars set forth as total expenses, there is another item shown on page 112, table 11, entitled "Outlay," amounting to $1,878,506.29. Whatever "Outlay" may mean, it certainly cannot mean "Income," therefore if one is justified in including this item with the other items of expenses the "Profit" before depreciation becomes $1,787,573.86.

A further scrutiny of Mr. Riley's report discloses no allowance for depreciation whatever. Even municipally owned and government owned plants depreciate just as do those under private ownership and management. If a fair allowance for depreciation may be taken at 5 per cent this item alone amounts in the aggregate to $2,269,139.45 on a valuation given by Mr. Riley at $45,382,788.95.

It would look to the casual observer as though the operation of these plants according to accepted accounting methods is actually in the red, so to speak, about half a million dollars instead of showing a profit of 28 per cent. Again, the electric light and power companies pay in taxes about ten cents on every dollar of gross income they receive, that is 7½ per cent of their gross income for state tax, 2 per cent for their franchise tax, and federal tax amounting to about ½ of 1 per cent more on the gross income. So it seems that viewed dispassionately these twenty-two plants in the aggregate have lost about half a million dollars and in addition to this loss the state of California and the counties in which these plants operate have lost in taxes a million and a quarter dollars more which they would have received had the selfsame plants been privately owned and operated.

Electragists Are Backing Up Their Trade Policy

HAVING laid down a trade policy for their industry, the Association of Electragists International is exerting every effort to see that this policy is lived up to, not only by members of that organization but by the entire electrical industry. Briefly this policy maintains that the most economic and efficient method of distribution of electrical products is from manufacturer through jobber to the contractor and dealer and thence to the consumer.

Knowing that conditions are hindering a complete realization of this policy one of the committees of the Electragists is making a series of economic studies in the hope that a solution will be forthcoming. The latest survey issued under the title, "The Balance Sheet of Distribution of Electrical Products," purports to show the distribution of the total output of electrical products in this country. Total manufacturers' production for 1923 is shown to be $1,398,058,686. Obviously the contractor-dealer is not interested in exports or in the products absorbed by commercial telegraph and telephone companies, central station generating and transmission equipment, electric railway supplies and apparatus, broadcasting and commercial wireless equipment and materials and supplies sold to other manufacturers for incorporation into their products. Subtracting the total in these classes leaves electrical products to the value of $476,097.961 in which the contractor-dealer is vitally interested. Of this amount only $212,500,000 passes through the contractor-dealers' hands. It is the balance that is worrying the Electragists. The survey shows that manufacturers are selling directly to consumers or to non-electrical outlets products valued at $152,500,000. Similarly, jobbers are by-passing the contractor-dealer with products valued at some $111,000,000.

Two types of competition are responsible for the fact that the electrical contractor-dealer absorbs only 45 per cent of the products in the group in which he is interested. The report classes as legitimate competition properly conducted central station merchandising, non-electrical and specialty stores and radio dealers. Illegitimate competition includes sales made by jobbers and manufacturers direct to consumers.

Admitting that there is no method by which their trade policy can be forced on the other branches of the industry, the Electragists are appealing for unselfish, broad-minded, fair and intelligent co-operation. In this they are correct. Only through careful study of their own problems and an interchange of thought with other branches of the industry will they gain the confidence and respect that is the foundation of fair dealing.

Hoover on Development of Water Resources

SOME measure of hope for the ultimate solution of the many problems which are standing in the way of speedy development of some of the major Western waterways was held out by Secretary of Commerce Hoover in his recent address before the Columbia River Basin League at Seattle. Speaking on "A National Policy in Development of Water Resources" Secretary Hoover cited as reasons for the determination of definite national policies the growing interstate friction, local litigation, political obstruction and even international friction.

No one will deny but that the West has its share of quarrels with respect to water. State jealousies have almost precluded early development of the Colorado River. There are few court calendars which are not clear of legal fights between irrigation districts. Municipalities, power companies and riparian land owners all have their clashes over water rights. The situation presents a mixture of litigation, emotion and even politics.

Secretary Hoover's suggested solution to the present muddle calls for the establishment of commissions with jurisdiction over each drainage area similar to the Lower Mississippi River Commission which has brought peace, finance, construction, flood-control and navigation where ten years ago there was nothing but trouble. Such commissions would be made up of representatives of the states and the federal government, together with independent technical members. The task of these commissions would be to "consider the engineering data, to think, to plan, to devise, advise, co-ordinate, negotiate, persuade and set upon the obstreperous." Major lines of policy would be outlined, financial

support organized and reconmmendations made as to who should undertake projects.

Such a program seems simple enough on paper but it will require pressure if the legislation to initiate it is to be forthcoming. If the electric light and power industry can see in this suggested program a solution to some of its problems then Secretary Hoover and those others who are responsible for its initiation should be so informed.

Rural Rates Must be Simple

SOMEONE recently made the statement that not even a Philadelphia lawyer could satisfactorily explain some of the rural rates which have been devised as a result of the attention which has been and is being devoted to the subject of rural electrification. Judging from the form of some of the schedules one of the chief fundamentals of rate making has been entirely overlooked, namely the need for simplicity.

Because California has been eminently successful in rural electrification over a period of development beginning in 1898, the schedules in effect in that state should serve as a helpful guide to those who are just now attacking the problem. On another page of this issue is the first of a series of two articles by a man who is not only familiar with the practices of the utilities but who has the interests of the farmer at heart. His comments on rates and rate schedules should be of exceeding value to the industry. One of the points on which he lays greatest stress is the need for simplicity. If his articles do no more than bring this thought home forcefully they will have been well worth while.

The Utility Company and Local Affairs

JUST how much should a utility company mingle in local affairs? Is not the utility an inseparable part of the life of the community and as such necessarily interested in all that takes place within it? These are questions to which much thought may be given, questions which have worried many executives in the past. Yet the answer to them may be reasoned from the fundamentals of fair play quite simply and unmistakably.

With the trend of utility management toward centralization and consolidation the question becomes of more than passing importance. In the old days when every little community had its individual plant and local power company there was small doubt as to the extent to which the power company should enter into community activity. Every stray political wind blew danger to the stability and continuity of such enterprise. For that reason each small company fortified itself with those men whose claim was that they could so manipulate local politics that no demagogue might wipe the company from the field.

It was from this period that many utilities earned an undeservedly shady name. More often than not they asked only to be let alone to pursue their business in a businesslike way, unharassed by political bellwethers who threatened their extinction. Thus antagonized they fell prey to another lot of political "strategists" who promised immunity at so much per immunization.

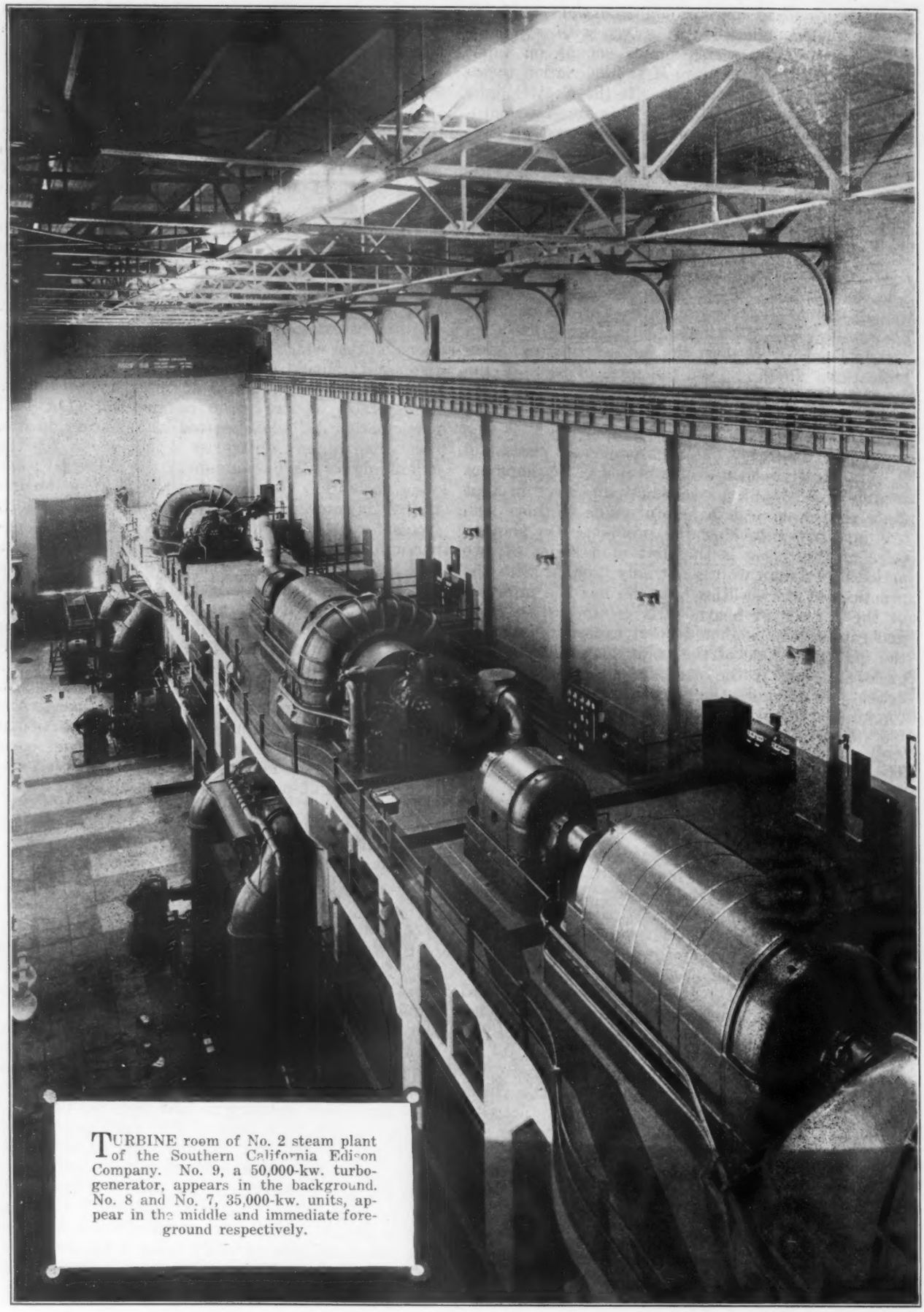
Consolidations and interconnections have removed the company, in many instances, from local interest in local affairs. The present tendency is one which would find its ultimate destination at the opposite swing of the pendulum. Yet this tendency toward complete divorce from the local scene is likewise unsound. While the local people dislike political interference they like only slightly less a complete indifference to their fate or fortune. They do not like to be completely ignored, even in their political troubles, and they do demand unmistakably that the utility company share in the non-political responsibilities which each business institution in the community should feel in local welfare.

Here, then, is the modus for participation in the local affairs of any given community. Let that participation be wholehearted and sincere in the furthering of any enterprise which works for the upbuilding of each community served. In some cases the utility company is asked to take the initiative in movements of public character which strive for a better community life. These are opportunities which no wise executive misses for in each of them is a potential mine of genuine good will.

It might be stated as an axiom, almost, that the utility which finally earns for itself by such public works the entire respect of each community it serves need fear little from the political misanthropes who would court favor by denunciations or legislation detrimental to that utility company. And thus, as a natural consequence of this particular type of participation in local affairs should come freedom from the necessity for that older and discredited type of participation in local politics.

Overcoming Insulator Rifle Practice

POWER-LINE insulators and road signs are the favorite targets of the army of hunters which each year at this time take to the field in pursuit of the wily buck. Rifle practice seems essential not only to the small boy with his pet .22 but to the more mature hunter as well. Each year serious damage is done in all of the Western states through the practice of shooting at insulators on transmission lines. Heavy loss and serious inconvenience to those sections dependent upon the lines for service is the result. As a result of overtures from the light and power industry in Michigan, the pamphlet containing the game laws of that state now carries the following warning: "Never shoot at an electric power line. An insulator damaged by a bullet menaces life and property, causes fires and interrupts service upon which thousands depend." Undoubtedly a similar warning would be printed with the fish and game laws of every state if the power interests were to call the matter to the attention of the respective Fish and Game Commissions.



TURBINE room of No. 2 steam plant of the Southern California Edison Company. No. 9, a 50,000-kw. turbo-generator, appears in the background. No. 8 and No. 7, 35,000-kw. units, appear in the middle and immediate foreground respectively.

Addition of Ninth Unit to Long Beach Steam Plant---I

Electrical Equipment

By G. A. Fleming

Electrical Engineer, Department of Engineering Design, Southern California Edison Company, Los Angeles

A 205,000-hp. steam-electric generating station on the Pacific Coast would have been considered a wild dream but a few years ago. Now such a plant is in operation on the system of the Southern California Edison Company. Some of the novel features of the recent 50,000-kw. addition to the plant are covered in two articles.

ON July 13 load was first thrown on unit No. 9, the new 50,000-kw. turbo-generator in the Long Beach Steam Plant of the Southern California Edison Company. This brings the total plant capacity to 205,000 kw., 34 per cent in the six units of the older section known as Plant No. 1, and 66 per cent in the three units of Plant No. 2. The first two units of the latter were installed in 1924. (Journal of Electricity, March 15, 1925, p. 199.)

The new generator is rated at 55,556 kva., 3-phase, 11-kv., 50-cycle, 90 per cent power factor, 1,500 r.p.m., and was built by the General Electric Company. It is star-connected and solidly grounded through an oil circuit breaker. On the same shaft is mounted a 4,000-kva., 2.3-kv., 3-phase, 70-per-cent-power-factor generator for station auxiliary power. Fig. 1 is a single line wiring diagram of the entire Long Beach station including both plants 1 and 2. Connections for the new unit are shown at the left.

An efficiency of 97.5 per cent has been guaranteed for the generator at full load. This with the high efficiencies of both the turbine and the boilers will produce an over-all efficiency of 24 per cent. It is expected that this figure will be maintained quite closely under operating conditions and that 430 kw-hr. may be expected per barrel of fuel oil. This is slightly better than for the two previous large units and 70 per cent better than is obtained from Plant No. 1, built 15 years ago. When it is considered that the investment per kw. capacity in Plant No. 2 has not been increased over that of Plant No. 1, and that operating costs are materially less, it is not hard to realize the change in economic relation that has taken place in the past few years between steam and hydraulic power production.

The unit has been liberally designed and the operation to date justifies the belief that it will be capable of producing power in excess of its rating. On the basis of Units 7 and 8 being able to carry continuous overloads in the amount of 28

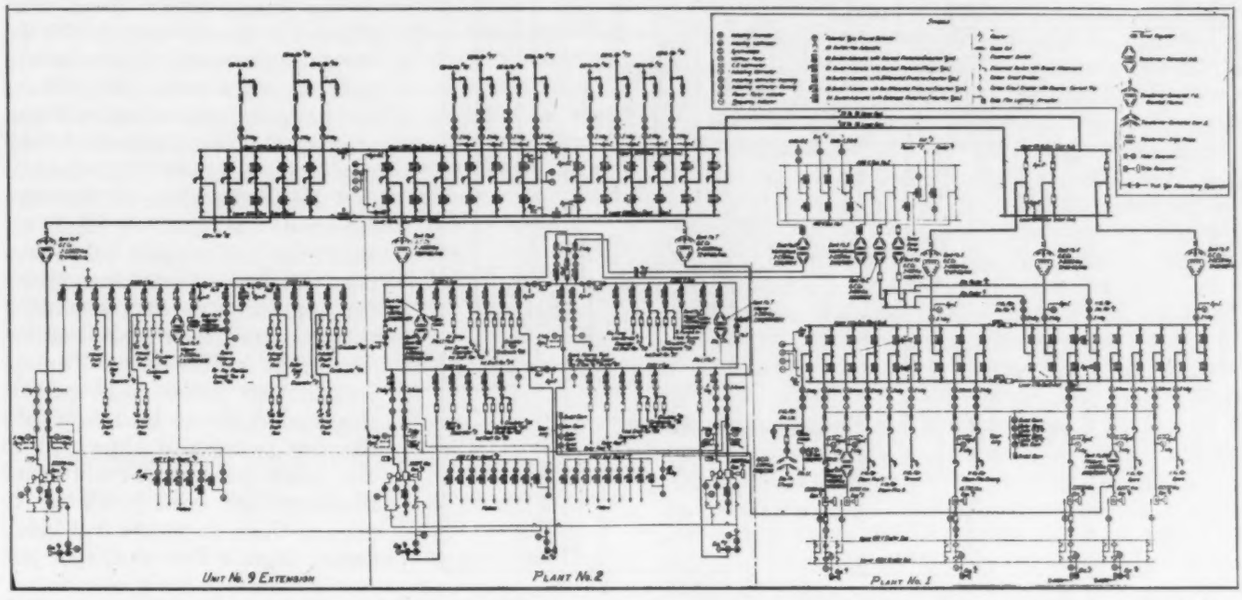


Fig. 1. Complete wiring diagram of the Long Beach steam plant of the Southern California Edison Company. Unit No. 9 addition appears at the left.

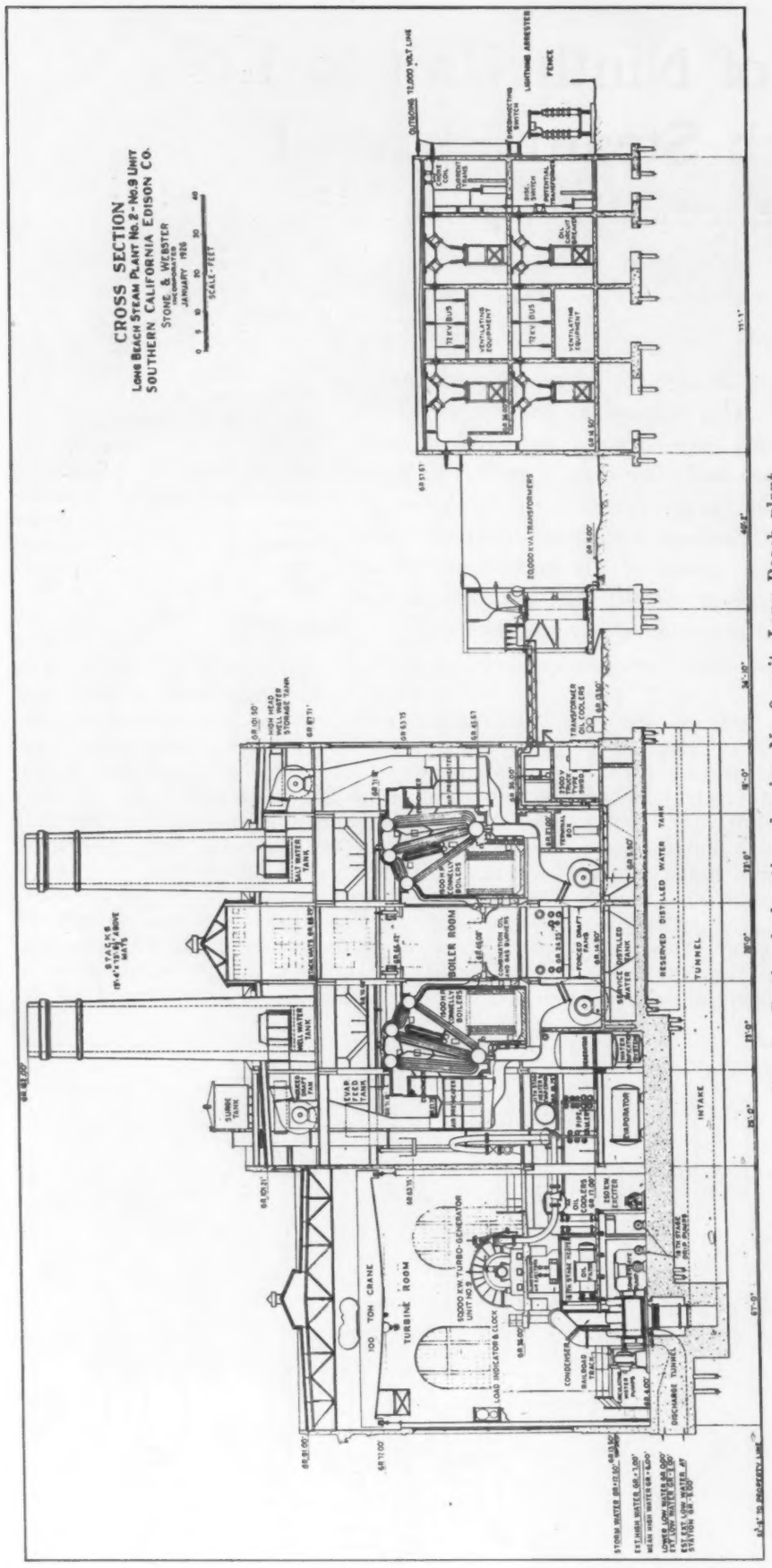


Fig. 2. Sectional elevation showing No. 9 unit, Long Beach plant.

per cent, a 60,000-kva. bank of transformers was installed for this ninth unit. Excess capacity allowances also were made in all other equipment.

Together with its 11/72-kv. transformer bank the unit is connected as a unit to the high-tension bus without low-voltage circuit breakers or buses. In a similar manner both the excitation and auxiliary-power systems are laid out as units with emergency tie lines only to other sources of power.

Low-tension conductors from the generator consist of 1,500,000-circ.mil copper cables, 4 per phase. These are insulated with varnished cambric with a flame-proof cover and are mounted on porcelain insulators in a large and well ventilated tunnel which passes under the boiler room to the outer wall of the plant. Here the cables give way to bare copper bars to which the instrument transformers are connected and which are carried out through wall bushings to the outdoor transformers in a well protected overhead housing of concrete and screen. The low-voltage bus at the transformers also is housed in a similar enclosure, largely to protect the closely spaced conductors and insulators from birds. Seagulls, of course, are very numerous at this seacoast plant.

The transformer bank consists of 3 20,000-kva., 11/72-kv. single-phase units, with a fourth that can replace any one of these by changing connections without moving the transformers. Cooling is accomplished by circulating the transformer oil through external water-cooled heat exchangers. Provision also has been made in the plant design for replacing or supplementing these coolers with air-cooled radiators at a later date. The object of this latter is to permit the heated air to be taken into the fire poxes and thus add to the boiler output. Transformer bushings are over-insulated to protect them from the salt-laden ocean fogs. Transformers are

connected delta-star with the neutral of the 72-kv. side solidly grounded to ground rods and to a power ground bus of copper conductors that is carried to all high-tension insulator buses, circuit breaker frames, and instrument-transformer neutrals and cases. The transformers also form the end of a much heavier copper ground bus that extends from the general neutral and frame to all low-voltage insulator bases and power equipment.

From the transformers the 72-kv. leads pass to duplicate buses. These are indoors in a switch house separate from the generating station, as is evident from Fig. 3. The bus extension for the new unit has three feeder positions, sufficient to take the generator output, and is separated from the original sections by oil circuit breakers. Bus-sectionalizing breakers are interconnected with the overload relays on the feeders in such a way that the bus-section breakers will open ahead of feeders on heavy overloads. This provision is necessary to protect the circuit breakers from rupturing short-circuit currents in excess of their capacity, even though the largest available circuit breakers were installed.

Each circuit breaker is in a fire-proof vault equipped with doors that will close automatically in case of fire. Carbon tetrachloride fire-extinguisher spray heads are installed in each vault and may be operated from a distant point. While generators 7 and 8 have carbon tetrachloride fire-fighting equipment, generator No. 9 has been equipped with a system of carbon-dioxide extinguishers. These provide for automatically releasing a quantity of gas into the enclosed air-circulating system of the generator. A saturated gas atmosphere is maintained by the delayed opening of additional gas tanks.

Control and Protection

To care for the control of the main electrical circuits two panels were added to the switchboard. This board is in three sections, a bench control board, instrument board, and relay board. It was manufactured by the Westinghouse company with standard instruments and relays used throughout.

On the bench board are the control switches for operating the main power circuits and the principal feeds to the auxiliary-power bus. In addition to the controls there are small knife switches that will disconnect the automatic relay trip from any circuit when desired. On the instrument board are mounted the usual indicating meters, including a governor-position indicator and a bulls-eye lamp to indicate an automatic tripping of the throttle. There also is a visual signal system for the transmission of definite signals between the turbines and the switchboard, such as "stop generator," "on line," etc.

The relay board contains the following:

Differential relays for main generator protection
Differential relays for main transformer protection
Differential relays for uxuiliary generator protection.
Overload relays for all 72-kv. feeders
Balanced relays for parallel 72-kv. feeders.

On the same board are mounted the integrating and the recording meters, as follows:

Watthour meter for main generator
Watthour meter for auxiliary generator
Curve-drawing temperature indicator for main generator
Totalizing element for total of station power.

Switchboard equipment, frame and instrument cases are all connected to a safety ground bus that grounds the equipment not directly connected with the power circuits, building steel, motor frames or other normally grounded positions. This ground system is not necessarily isolated from the power ground bus, but the power bus is arranged to carry its ground currents to the points sought by making the paths as short as possible. This prevents such currents from reaching unrelated equipment or passing over the safety bus, the latter being only to maintain auxiliary equipment at a safe ground potential.

Auxiliary Equipment

The auxiliary power system involves more details and complications than do the main generator circuits. All motors over 50 hp., of which there are several as large as 450 hp., are operated at 2.3 kv. from the auxiliary generator mounted on the same shaft as the main unit. Smaller motors are operated at 440 volts and are served through a transformer bank from the 2.3-kv. system.

An assembly of truck-type oil circuit breakers forms the 2.3-kv. bus. This bus is divided into two groups by a sectionalizing switch so that trouble on either half will not incapacitate the main unit. A spare truck makes the replacement of any one circuit breaker very simple and possible without affecting any other circuit.

To provide emergency feeds to the 440-volt motors tie lines have been run between similar motor circuits of two main generator groups. A double-throw switch near each motor is used to select the source of power. In a similar manner two d.c. circuits have been carried from the storage battery to the valve control panels where a double-throw switch gives duplicate circuits to these important controls. In the control of the principal steam valves a secondary station has been provided outside the boiler room from which the steam lines can be cut off in case of emergency. The d.c. feed also is carried to an automatic switch for transferring part of the illuminating circuits to the battery in case of an interruption in the normal a.c. supply.

All motors are either push-button or automatically controlled and all constant-speed motors except the very largest are designed for starting at full voltage. An effort was made to use constant-speed motors wherever possible. Among the more interesting applications of automatic controls might be mentioned those on the draft fan and boiler feed pump motors. The motors on the induced draft fans are of the brush-shifting type and are equipped with a sensitive speed-control system manufactured by the Smoot Engineering Company. This system

is arranged to maintain automatically atmospheric pressure in the fire boxes of the boiler. The motors on the boiler-feed pumps are of the slip-ring type and are equipped with a Ruggles-Klingerman regulator that varies the speed to maintain the pump pressure above the steam pressure in the boilers.

For alarm circuits the annunciator system in the original switchboard room has been extended to include the new circuit breakers and contacts for hot generator and transformer alarm. At the turbine gage board a second annunciator is provided to indicate the automatic opening of auxiliary circuit breakers, high and low-water alarms, low vacuum, excessive moisture in the generator cooling system, and other undesirable conditions.

A centrally controlled electric clock system synchronizes clocks located in the switchboard, boiler, and turbine rooms. For the calling of maintenance men numerous small electric horns are placed about the plant on which any given code call is repeated automatically three times upon pressing a single button.

The steam condenser of the main unit is equipped with the Electrolytic Protection Corporation's system of positive anodes for the prevention of corrosion.

Addition of Ninth Unit to Long Beach Steam Plant---II

Steam Equipment

By Raymond Wilcox

Steam Power Engineer, Department of Engineering Design, Southern California Edison Company, Los Angeles

EXTENSION of the Long Beach Steam Plant of the Southern California Edison Company to accommodate the newest and largest generating unit involved some features novel to the Pacific Coast and of especial interest to power plant men on the Western side of the Rockies.

The 50,000-kw. General Electric turbine was built in the same size casing used for the two 35,000-kw. machines installed in the plant two years ago. The increased capacity is taken care of entirely in the design of the blading and steam passages. This made possible the uniform extension of the generating room and the turbine platform. An advantage of this turbine construction also is reflected in the interchangeability of bearings and other parts.

It has been found possible to carry loads of 45,000 kw. continuously for long periods on the 35,000-kw. machines and a capacity in excess of 60,000 kw., with full-extraction feed-water heating is anticipated for the new unit.

Steam conditions at the turbine throttle are 365 lb. pressure and a total temperature of 725 deg. F. In the feed-water heating cycle the condensate passes through the eighteenth stage extraction heater, the gland steam condenser, the air ejector after-condenser, and the deaerating vented heater which normally is supplied with steam extracted from the fifteenth stage. Full-load temperature at this latter point is 248 deg. F., and the pressure of the condensate is increased by booster pumps to 165 lb. After passing through the booster pumps the feed water is used to condense the evaporator vapor and then passes through the eleventh stage extraction heater wih a final temperature at the boiler feed pumps of 360 deg. F. Evaporators are supplied with steam extracted from the eleventh stage of the turbine. The feed-water heaters were manufactured by C. F. Braun & Company of Alhambra, Calif., the deaerator by the Cochrane Corporation and the evaporator by the Griscom-Russell Company.

The condenser, a picture of which appeared on page 548 of the Journal of Electricity for June 1, 1926, is of two-pass divided-water-box type with 75,000 sq.ft. of tube surface. The tubes are rolled into the tube sheet on the inlet end and project about 4 in. in from the face of the tube sheet. The projecting ends are slightly belled to improve the entrance flow of cooling water. The condenser, circulating-water pumps, and condensate pumps were

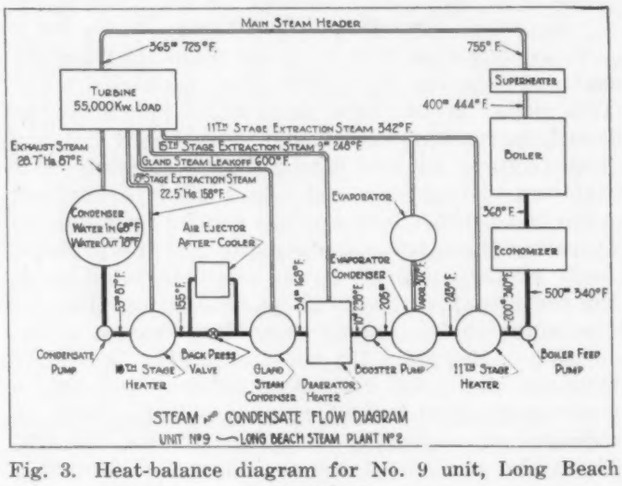


Fig. 3. Heat-balance diagram for No. 9 unit, Long Beach steam plant.

furnished by the Westinghouse Electric & Manufacturing Company. Temperature of available condensing water varies from 58 to 72 deg. F. The capacity of the circulating water pumps is 100,000 gal. per min.

Boiler House

In the boiler house is found the greatest change in design in the extension of this plant. Seven new Connelly boilers furnished by the Llewellyn Iron

Works of Los Angeles are installed. They are of the four-drum bent-tube type, 50 tubes wide and each having 15,000 sq.ft. of surface. They are equipped with water-cooled side and front furnace walls. These walls, manufactured by the Bailey Meter Company, now a subsidiary of the Babcock and Wilcox Company, are constructed with refractory-faced blocks clamped to the circulating tubes. These are the first boilers on the Pacific Coast to be equipped with this type of furnace. The use of water-cooled walls was considered necessary with the use of preheated air. Floors and bridge walls of the furnaces are air cooled. During preliminary operation preheated air temperatures of 275 deg. F. and stack gases as low as 225 deg. F. were realized. Air preheaters were manufactured by the Green Fuel Economizer Company and economizers installed were made by the Power Specialty Company.

Six of the new boilers are equipped with Foster 3-loop protected-surface type of superheaters. No cores are used in these superheater elements, but hollow plugs in the inlet ends of the tubes are employed to insure even distribution of the steam throughout all of the 80 elements in each superheater. The seventh new boiler is equipped with an Elesco superheater.

In addition to the usual boiler gage-board instruments each boiler has a multi-point Leeds and Northrup temperature recorder. This places before the operator a continuous record of temperatures of the superheated steam, gas leaving boiler, water leaving the economizer, gas leaving the economizer, aid leaving the preheater, and gas leaving the preheater.

Miscellaneous Equipment

Manually controlled forced-draft fans force the air for combustion through the preheaters and air-cooled walls. Automatically controlled induced-draft fans maintain a balanced pressure condition in the furnace. Gas fuel is available from the adjoining city of Long Beach when domestic requirements are light. Combination oil and gas burners of the swing-front type manufactured by the Peabody Engineering Corporation are used.

The oil burners are of the mechanical atomizing type, the oil being heated in heat exchangers using live steam. No oil meters were installed in this extension of the plant because of previous unsatisfactory experience with them. Gaging and liquid-level recorders will be relied upon for computing the oil used from the service tanks.

A motor-operated gate valve has been placed in the steam lead to the turbine adjacent to the throttle valve. This valve is in addition to the usual gate valve against the main steam header. The purpose of this additional valve is to permit keeping the 20-in. steam lead to the turbine hot without risk of steam leaking past the throttle valve when the turbine is shut down. An open blow between the gate valve and the throttle valve insures this safety. It was found that, in starting up the other turbines, about 45 min. were required to heat up the turbine lead. The additional valve will eliminate this delay in starting the new unit. Valves in the main steam piping were furnished by the Chapman Valve Company and the cast steel fittings were made locally by the Warman Steel Casting Company.

In connection with the extension of the plant for the new boilers, sand filters and Zeolite water softeners were installed to treat the make-up water for the evaporators of all three units. These were put into service several weeks before the new turbine was ready to operate. Experience had shown that

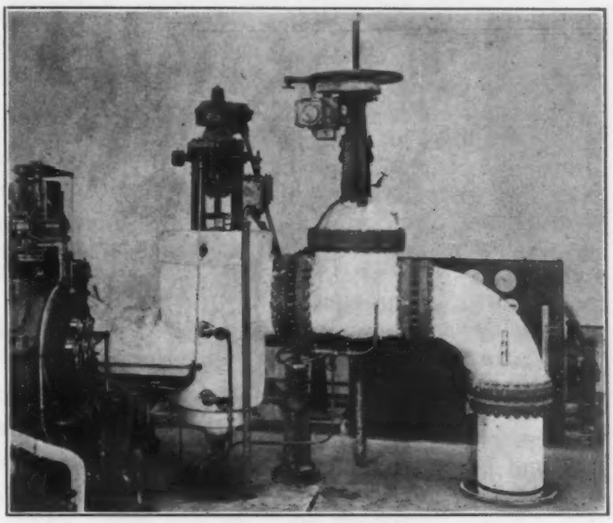


Fig. 4. Steam lead to No. 9 turbine showing throttle valve and motor-operated gate valve.

the capacity of the evaporators steadily decreased until it became necessary to rasp and hammer the hard scale off the evaporator coils. Since the installation of the softeners the performance of the old evaporators has shown a remarkable improvement and scale is loosening and falling off the coils and passing out of the evaporators through the blowdown. No scaling of tubes in the new evaporator has been observed. The filters and softeners were manufactured by the Cochrane Corporation and furnished by C. C. Moore & Company.

About four points better efficiency is expected of the new boilers equipped with air heaters and water-cooled walls. However, at higher vacuum and heavy loads the performance of the new turbine may not be as good as that of the 35,000-kw. machines due to the crowded steam passages. On the average a somewhat better economy is expected of the plant because of the improved new equipment installed in the extension. Under the favorable load conditions which obtain in those periods of the year during which a large percentage of the Edison system load is carried by the steam plants an over-all plant thermal efficiency of 14,500 B.t.u. is expected.

The new turbine and equipment were installed and the extension of the Long Beach plant was carried out under the supervision of G. C. Ward, vice-president in charge of construction of the Southern California Edison Company. Stone & Webster, Inc., were the engineers and constructors.

Rural Electrification from an Economic and Engineering Standpoint—I

Economics and Development of Rates

By L. S. Wing*

Engineer, California Farm Bureau Federation, San Francisco

WHILE much has been said in recent years on the subject of rural electrification, there are some phases of the problem yet to be solved. In this paper, which will be published in two parts, the author, who is a representative of the farming group, discusses the questions of rates and rural extension policies with special reference to the progress which has been made in California where the greatest rural electrification development has taken place.

THE question of extending electric distribution lines to rural districts is not alone one of poles and wire—so many insulators and transformers—but one of maintaining the standard of living of thirty-five millions of rural people on a parity with their eighty millions of city cousins. Much has been said during the past four years of the problem of rural electrification and there is at present a great urge in that direction. Many prominent men have expressed their views on the subject, and leaders of the electrical industry have shown a keen interest and appreciation of the obligation of their industry to render service to rural communities. There are those, however, representatives of both electric utilities and agriculture, who see the problem only from a cold statistical point of view, and they gingerly examine the facts presented, applying safety factors and contingency percentages to every unknown until they arrive at results which appear most discouraging. Cost accountants and rate analysts have produced many valuable data but not the final answer. Service to the agricultural industry is too complicated to be solved by a mathematical formula. It involves social demands and responsibilities which are just as important as the kilowatt demands and system peak responsibilities with which they must be considered. The agricultural industry is the real backbone of the nation, and those engaged in it have a right to demand that they be given an opportunity to maintain themselves upon a plane of living comparable with workers in other industries.

At the inception of the electric industry some forty-four years ago its promoters were obliged under the then competitive conditions to develop such loads as promised the greatest profits; the struggle was for survival, and the failures were many. Today under public regulation this condition no longer exists. The central-station industry is regarded as one of the safest of investments; it is one of the few that can boast of never having experienced a reduction in its gross revenue. The industry is firmly established; it operates as a monopoly, generally under state control, and as such it owes a duty to the whole territory, both urban and rural, in which it is located and not to certain especially profitable sections which selfish interests might dictate as being the reasonable confines of its service area.

This comment should not be interpreted as meaning that the farmer is to be subsidized by the state, the utility that serves him, or its present consumers. It does imply that further reduction in existing urban rates may have to be postponed in some cases in order that the utility may pioneer rural lines; also, that the utility forego what might be termed a full return upon its rural investment during that development stage of the business. The farmer must be served from the start at rates he can afford to pay and which make further use of this power attractive. Rates based upon eight and ten per cent return upon the investment from the start, with full pro rata allocation of all operating costs and fixed charges, will serve only to stifle development. The rural load must pay its share eventually, but it cannot be expected to spring fully matured and developed from the seed. No other class of load served by the electrical industry has been fully profitable from its inception.

What the farmer can pay and the amount of his annual consumption will depend entirely upon how much electricity he can use beneficially to supplant present sources of fuel and power and the scale of living he can afford. With the introduction of electricity into rural districts that standard of living will be raised; soon what was deemed a luxury will become a necessity just as have the telephone, the automobile and the radio.

Vision is needed when dealing with a problem so full of possibilities. Rural revenues and cost-of-service studies based on present and probable energy consumption of 300 to 1,000 kw-hr. per

* Extract from a paper before the annual convention of the American Society of Agricultural Engineers, Lake Tahoe, Calif., June 23-26, 1926. The second and final section of the paper will appear in the next issue.

farmer per year are not only discouraging but misleading. Rural service in general cannot be justified economically with such a low consumption. There exists a great opportunity to better living conditions on the farm and to cut down the cost of farm labor. Considering present applications, electricity can be sold in many rural districts only in quantities which will make the load profitable to both the utility and the farmer. This is the only foundation upon which rural electrification can rest safely.

To anyone studying the problem of rural electrification for the first time three questions naturally might occur:

1. What factors in the past have influenced electrical rates and the extension of service to new loads?
2. What form of rural rates and extension policies have been used, and with what success?
3. What are the factors to consider in determining the amount and form of rural rates and the terms of an extension policy?

Any one of the above topics might be made the subject of a paper, so necessarily the treatment given here must be somewhat general.

At the beginning of the central-station industry the only loads served by the companies were street, business and residence lighting. Rates were high because plant investments were high in proportion to the amount of energy sold. The subsequent reduction was made possible only by the development of the electric motor and its widespread application and use in the railway and manufacturing industries. To illustrate this effect upon the cost of power typical load curves of the period from 1882 t0 1900 and for the period from 1912 on are shown in Fig. 1. In the earlier period the annual peak, practically all lighting, occurred about 6 p.m. on a

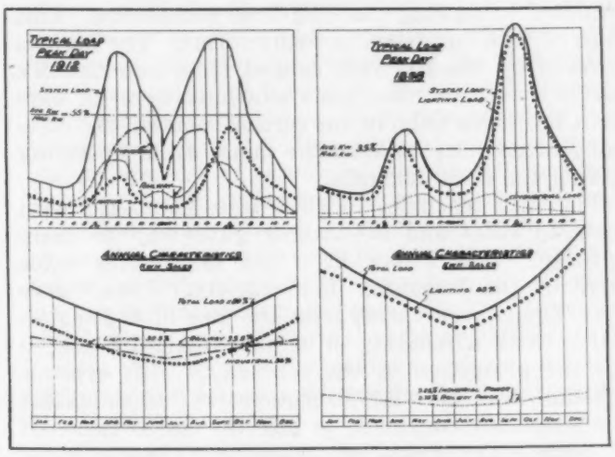


Fig. 1. Typical load curve during early development of electrical industry.

winter day. Even the development of railway and industrial loads has not changed peak conditions materially in the Middle West and East; the load curve still contains a summer "valley."

In this respect California and other Western states hold a unique position. The presence of the agricultural motor load used in connection with irrigation which is on heavily in summer and off in winter fulfills perfectly the needs of the central-station industry. This load has increased the system load factor so greatly that production and transmission costs to California utilities are generally far less than they would be to Eastern utilities, regardless of power sources. In fact, the ex-

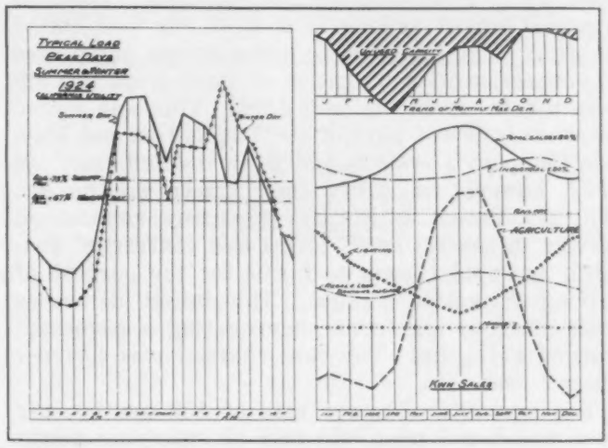


Fig. 2. Typical load curve for large California utility in 1924.

istence of the agricultural power load should be valued almost as highly as that of hydroelectric resources which are so abundant in this section of the country. Each has contributed a large share to the cheap production of electricity.

The present daily load curve of one of the largest California utilities is shown in Fig 2. It has an annual load factor of 62 per cent; its connected load is made up of lighting, cooking, heating, industrial power, railway, mining and agricultural power for pumping, which accounts for its unusually high annual load factor. The summer peak is nearly as high as that in winter. Particular attention is directed to the shape of the agricultural power sales curve and the manner in which it fills in the summer valley; also to the effect of this load upon the monthly peak demands. Many of the loads at present served by this utility at a profit could not economically be served separately with electrical energy.

In the same way that many different kinds of loads can be served more economically by one system than they can separately, so it is often in the case of utilities themselves. The consolidation of small electric companies into large systems and the interconnection of these large systems have proved very beneficial to all users of electricity, for they have made possible higher load factors, thereby decreasing the amount of idle equipment on which consumers had to pay fixed charges.

From the foregoing, it is evident that any breaking down of system loads into their component parts such as is threatened by numerous municipalities throughout the country at the present time can result only in undoing the progress already made and postponing the day when universal rural electrification will become an accomplished fact, for

it is certain that only with the economies effected by a highly diversified local load, coupled with the further economies which result from interconnection and consolidation, is general rural electrification possible.

Forms of Rural Rates

Agricultural electric rates and extension policies, contrary to general opinion, have a history covering a period almost as long as that of any load except lighting. The first electric motor-driven pump used in connection with irrigation of farm crops in California dates from the year 1898. This was served by what is now a part of the Pacific Gas and Electric Company's system, and is an isolated case. In 1889, however, a utility then known as the Mt. Whitney Power & Electric Company commenced service to several small towns and contracted generally to supply power to farms for the purpose of driving irrigation pumps. The initial deliveries were made to ten farms, aggregating a connected load of 174½ hp. The rate charged was $50 per hp. per year.

The agricultural power rate of $50 per hp. per year was based upon the cost of supplying power for irrigation from the only other available source of supply, namely, gasoline and steam engines, and the cost of supplying this service electrically. The company management chose the flat rate because its power was produced in a hydro plant and the annual fixed charges constituted practically the entire cost of delivering energy. Also the rate was simple, the farmer knew exactly what the new form of energy would cost and the company was assured a stable income.

The connected load records of this utility report the agricultural motor load as follows:

1899	174.5 hp.
1904	1,406 hp.
1907	2,928 hp.
1909	4,430 hp.
1911	6,654 hp.
1914	12,470 hp.

Gasoline-engine competition was keen during this entire period, and it was not until 1910 that the electric motor became a real factor in irrigating farms in this state. Since that date growth of rural electrification has proceeded at a rapid pace until today it is estimated that between 60 and 80 per cent of all California farms have electric service. No accurate figures have been compiled yet for 1925, but it is certain that between 600 and 800 million kilowatt-hours of energy now are being consumed annually in rural California for irrigation, cooking, heating, lighting, etc. This is more than is used for similar purposes in like territory in all other states. The present electrical connected load of all kinds on California farms likely is in excess of 750,000 hp.

As almost every crop grown in the United States and every branch of agricultural practice may be found somewhere in this state, the form of rural rates and extension policies used here and found satisfactory should be of interest to all. The various types of agricultural power schedules which have been tried out are too numerous to be listed here. Practically all of them have proved unsatisfactory in practice and gradually have been eliminated from use until today the major portion of all power used in irrigation practice is sold under two forms of schedules, and the time is not far distant when all power used by farmers will be sold under one type of schedule known as a two-part rate or the demand and energy type. Several of the more prevalent types of schedules are represented graphically in Fig. 3.

Agricultural power was sold first under the "flat rate" schedule which already has been mentioned.

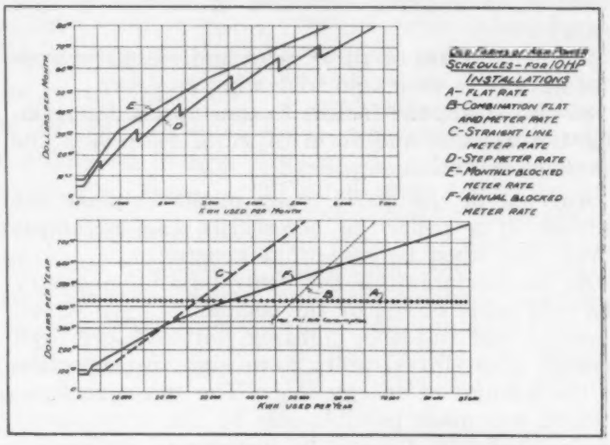


Fig. 3. Early types of rural rate schedules.

It is indicated by the line "A." This type of rate is particularly objectionable in that it encourages waste of energy; the consumer often uses more power than he needs. Also with this type of schedule the short-time users make up the losses incurred in serving the long-time consumers. This type of rate flourished in many forms. The periods covered by the flat rate ranged from one month's use to twelve months; some schedules were for daylight operation only, or for certain months, the company attempting to keep the motor from operating during the peak demands.

Flat-rate schedules in 1903 were combined with metered rates and afterwards gave way to them entirely. (Cee Curve B.) The first meter rates were of the "straight line" variety. (See Curve C.) The charge varied with the size of the installation, with a monthly or annual minimum charge for the protection of the company. This type of schedule was likewise discriminatory; it compelled the long-hour consumer to pay the losses incurred in serving the short-time operator. Metered rates of this type were given practically the same variations as had been given to the flat rate. The minimum charges were varied for the months of the year in which the plan operated; different rates were made for daylight use than for continuous service. The kilowatt-hour rate sometimes varied with the size of the installation and the schedule usually carried a rather high minimum charge. None of these schedules followed a reasonable cost of service curve.

Another type of rates used is that called the "step meter rates." This type of rate, shown by Curve "D," had a minimum charge based on the size of the installation, and straight line energy charge which varied each month with the load factor of the motor. It was often cheaper for the consumers to use more energy and thereby get into the next lower "step." It did not follow closely the cost of service and was discriminatory.

Another form of meter rate, shown by Curve "E," subsequently was used to a considerable extent and this also resulted in discrimination between customers. This was the block-energy form of rate with a monthly minimum charge similar to present lighting schedules. A consumer started each month with a high-cost energy block, then as his monthly use accumulated he would pay progressively less rates for each block of energy used. With this kind of schedule it became necessary for the farmer to guess the date the meter reader next would appear and crowd into the interval all the consumption possible in order to get a low rate for the month, or else wait until the meter was read before starting to irrigate. This was often done when it would have been more advantageous to both the farmer and the utility if the farmer could have spread his use throughout two, three, or more months in accordance with his needs and convenience.

The latest type of schedule employing the blocked meter rate with a minimum charge is one still used to some extent in California. It is indicated by Curve "F." While it is not entirely satisfactory, it is a great improvement over its predecessors as the minimum is on an annual basis and varies with the size of the installation; the energy is blocked also on the basis of the size of plant and the rate varies with the number of kilowatt-hours the plant consumes annually. The form of rate, however, which is now used almost entirely for the sale of agricultural power is the two-part rate; the demand charge is stepped according to the size of the installation, and the energy charges are blocked according to the annual consumption. This rate schedule is illustrated in Fig. 4. This type of rate follows as closely the cost of service as commercial considerations will permit; it is simple in application and easily explained and justified. Experience with the various rate forms and economic considerations have led to the following conclusions relative to schedules for agricultural power purposes. Most of these conclusions are general and would be applicable to any service sold to rural consumers. Some, however, refer only to the sale of energy for power uses in the West.

Desirable Features of an Agricultural Power Schedule

1. The company should own and maintain all facilities for rendering service.

2. Where a large part of the energy generated by the company is produced in hydroelectric plants, the rate for power during the spring run-off should be low.

3. The major portion of the annual charges should be collected in the months of maximum use.

4. Rates for each size of installation should follow, as nearly as practicable, the cost of service, but the schedule should contain sufficient differential in cost due to size of installations as to discourage the use of larger motors than required.

5. Each consumer should pay at least the cost of service directly incurred in serving him.

6. The rate must be low enough to meet the competition of other kinds of available power.

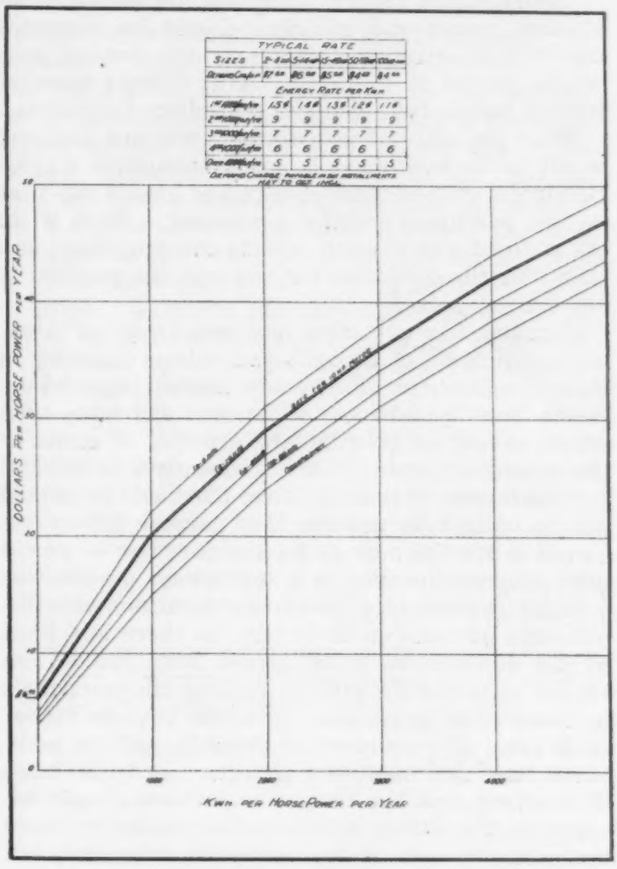


Fig. 4. Two part rural rate now used extensively in California.

7. The rate for energy, aside from "readiness to serve" charge, should be as low as the total cost of serving will permit.

8. The rate schedule should be simple.

9. The rate schedule should collect charges on an annual basis and permit use of plant at consumer's option.

10. The rate schedule should be applicable to all classes of farm power service.

11. Only one rate schedule should apply to the service used.

12. Charges made under the rate schedule should be based upon factors directly within the consumer's control.

Ownership of Service Facilities

The first important feature which should be incorporated in a rate schedule is ownership by the utility of all facilities used in the rendering of

service; that is, everything up to and including the meter. (Future development of load may justify even the inclusion of large motors for temporary service.) Only large consumers can afford to have someone competent to inspect and repair electric equipment always available. The average man does not know that a fault has developed until after it has done visible damage; he usually has to call in an electrician to make even minor repairs and replacements.

Transformers require attention periodically; insulators, wires and switches should be inspected carefully in order to prevent serious damage at a critical period of operation. The utility's force of trained men is best equipped to perform this service.

When purchase of transformers and line material is left to the consumer, he often buys from a price standpoint rather than quality and soon finds that he has purchased inferior equipment. Even when the utility furnishes and installs the equipment and then bills the consumer for the cost the problem is not entirely solved.

Farming, like any other business, requires intensive application of thought and energy in order to make it successful. Every new element injected detracts from the business of farming and takes time which should be given to the growing of crops or the raising of herds. Not infrequently it is difficult for the farmer to finance power lines, and he should not be obliged to use for this purpose money required in his business or for the purchase of power utilization equipment. It is not always possible for a utility to extend its lines to serve consumers without some advance on their part, as there is a limit to the distance to which power lines can be extended economically without making the company's investment so great that it would require higher rates from all consumers in order to pay the additional fixed and operating charges. In these cases it is proper that the farmer or farmers should advance to the utility a reasonable amount towards the excessive cost of the particular extension, but this advance should be returned to them as quickly as the new business becomes profitable.

Desirable Features

The second desirable feature can be accomplished by a rate schedule on an annual basis in which the consumer's year, with the high-priced energy blocks, starts just after the flush hydro run-off where this is a factor. Practically all agricultural power schedules in California are so designed, and this feature has had a marked effect upon increasing the annual load factor of the consumer and also beneficially utilizing hydroelectric energy which otherwise would have been an economic loss.

There are two reasons why the consumer should pay the major portions of his bill during the period in which he makes the major use of his installation. First, he mentally measures the cost of the service which he receives with the use he has made of it, and usually fails to consider that a large portion of the cost of service is composed of fixed charges which continue regardless of the use made of the equipment. Collecting fixed charges during months in which little or no use is made of equipment is to him equivalent to "paying for a dead horse." The second objection arises when a renter is operating a farm. The majority of farm operations take place during the summer months, so if the renter leaves in the fall he often has not paid a proper share of the fixed charges on the plant since it may have been installed chiefly for use in the summer season.

The rate schedule should be designed to follow as nearly as practicable the trend of service cost for each size of installation. This cost increases so very rapidly per horsepower for small sizes of motors that in practice it is not feasible to charge them with the same proportion of demand cost as the larger sizes. By maintaining a diffential in costs and favoring the smaller sizes, over-sized installations are discouraged and a better load factor maintained. In the past, rates often have been designed which permitted a large installation to operate at a low load factor at about the same cost as a small plant at a high load factor; with the result that consumers usually installed larger motors than required and costs of serving them were higher than warranted.

Point number five is the one most likely to cause misunderstanding between the consumer and the utility. While most everyone readily will concede the fairness of each individual paying the costs of service which are incurred solely for his benefit, yet the attempts of utilities to collect these charges in the form of so-called "minimum charges," "demand charges," "readiness to serve charges," "service charges," or "meter charges," has led in many cases to either misunderstanding or dissatisfaction. A more comprehensive examination of this part of the rate schedule therefore, is justified and will be taken up later.

Meeting Competition

Competition from existing and potential sources of substitutional service always must be considered in making a rate. Fixed charges and general expenses cannot be assessed against each class of service on a proportionate use or demand basis and then rates derived therefrom that will be practicable. Average costs also have proved valueless in solving commercial problems. Careful consideration must be given to what the consumer can afford and is willing to pay for use of energy for each application to which the rate applies; he measures the reasonableness of the rate by the service which electricity performs for him, and what it costs to perform similar service by other methods—not by so many cents per kilowatt-hour. For lighting he will pay the highest rate; for space heating, the lowest.

A low energy rate encourages greater use and a wider application of electric service. A properly designed rate schedule makes the consumer mentally charge against the higher user such as lighting, refrigeration, and the operation of small domestic appliances a large portion of the fixed charges.

Further use of electricity for cooking, water heating and general farm operations then becomes profitable, as the additional energy charge alone needs to be considered. In other words, the farmer looks upon these applications in exactly the same way as did the early central-station managers when they made low rates for power in order to reduce their average cost of production.

One of the most important features of any rate is that it be simple. The simplest form of schedule is the flat rate, but this type does not spread costs of service equitably among consumers. The two-part rate is relatively simple; it is easily explained and justified if the demand charges are not made too high, since the major portion of the demand charge usually is comprised of items with which the farmer is familiar, such as interest, depreciation and maintenance of meter, service, transformer and distribution lines, meter reading and billing. It is also essential that the consumer be able to check his bills from the schedule of rates.

The undesirability of monthly type rates previously has been pointed out. They not only make it more difficult for the farmer to estimate his power costs, but add another element of chance to his operations. Monthly type rates are also basically wrong since they make various charges for the same service, although the cost of rendering that service is practically the same in each case. The greater portion of the costs which make up the total amount charged agricultural power consumers are interest, depreciation, taxes, and maintenance. These are costs which normally are figured on an annual basis, and whether a consumer uses all of his consumption in one month or spreads it over six months or more is of no consequence, if his maximum demand is the same in amount and time, as it does not in any way affect the amounts of these major items.

Schedules for lighting, cooking and other services which apply to service used fairly uniformly throughout the year may be charged for on monthly schedule, one in which the consumer starts each month's use at the highest block, without any great discrimination occurring.

If possible, all farm power used should be taken through one meter. This gives economy in investment, meter reading and billing, and also encourages greater use of energy by the consumer since the average rate becomes less as the load factor increases.

Until quite recently most California power companies offered numerous optional schedules for agricultural power service. The choice of the proper schedule was impossible unless the use of energy was known definitely in advance, which was seldom the case. Much misunderstanding, dissatisfaction and useless work resulted from this cause. One properly designed schedule should take care of all energy used for power purposes in permanent installations.

Charges made under a schedule should be based upon the equipment installed by farmer and the use he makes of it. It is true that the amount properly chargeable to the consumer depends upon the size of meter, transformer, cost of service wires, and the like, but these are items concerning the cost and operation of which he knows nothing. He is a farmer, his business is the production of agricultural products, not investigating the reasonableness of the size of wire used in the distribution system, or maximum demand of his load and the kva. capacity of the transformers required to serve it. If he puts in a 10-hp. motor and the rate schedule approved by the Public Service Commission says that he must pay a demand charge of $75 annually on this size of motor and that the energy rate is 3 cents per kw-hr., he will not question the correctness of the charge. But if he is charged the same amount and the charge is based on the size of the meter or transformer installed by the company, he likely will have a suspicion in the back of his head that a smaller size would have answered the purpose quite as well, and that it is just another way the "soulless corporations" have of getting misgotten gains. Wherever possible, schedules should be written in terms with which the farmer is familiar and be based upon factors over which he exercises direct control.

The Combination Rate

What is known as the "combination rate" is used almost universally in both urban and rural districts for domestic service where cooking and heating are involved and for this purpose this type of rate is satisfactory. It permits the entire household use to be taken through one meter. A graphical repre-

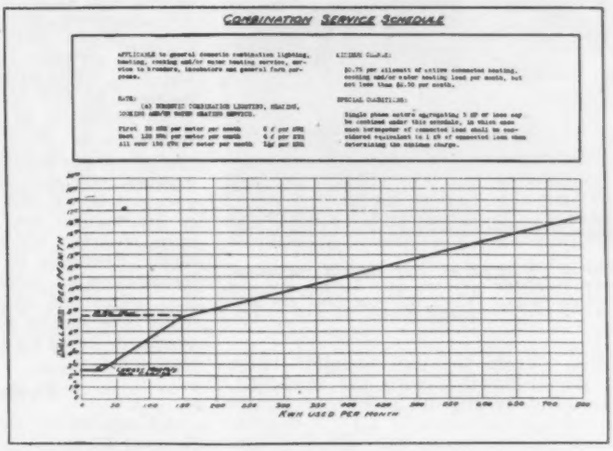


Fig. 5. Combination domestic service rate used in California.

sentation of the rate is shown in Fig. 5. Single-phase motors up to 5 hp. also may be served under this type of rate. Operation of such motors usually will be upon the last energy block, so the fact that the schedule is of the monthly type will not be discriminatory for small power uses although seasonal in character. Under this type of rate the first block is designed to cover lighting and small appliance use, the next refrigeration and cooking, the last block heating, operation of brooders, incubators and general farm power applications.

CENTRAL STATION CONSTRUCTION OPERATION AND MAINTENANCE

Automatic Sub Increases Track Capacity 11 Per Cent

Emergency Remote Control Provides for Extra Operation Station Normally Controlled by Time Switch

By H. P. BELL, Chief Engineer, Key System Transit Company, Oakland, Calif.

A 15,000-kw. automatic substation located out in San Francisco Bay about two miles from the eastern shore now serves one of the heaviest concentrations of traffic in that entire region. This station is one of the largest automatic railway substations now in existence and is in a class entirely by itself as far as its system of control and operation is concerned.

The Key System Transit Company operates a combination electric interurban and ferry-boat service between the several communities on the inland shore of the bay and San Francisco on the peninsular side. The ferries operate from the Ferry Building at the foot of Market Street in San Francisco to a pier terminal connecting with the inland shore, a distance of about three

Fig. 1. Exterior of Key System substation. Note ventilator openings near ground line and beneath eaves. Cables in foreground are temporary leads.

miles. From the pier terminal there is rail connection with the mainland, operating over about a mile of trestle and about two miles of fill. A double-track line traverses this distance, the various branch lines fanning out from the shore end to serve the several population centers located beyond that point.

Trains traveling to and from the pier terminal consist of from one to eleven cars each and operate in groups under a 50-sec. headway to meet boats running on a 20-min. regular and 15-min. peak-load schedule. In this manner 638 trains per day are operated through this 3-mile "throat" of the system. It was to meet the exacting power demands of this portion of the system that the new substation was designed and built.

This application called for a most reliable installation which would operate successfully on large overloads for short periods and, when overloaded to the safe temperature limits of the equipment, would "back off" from the load but still hold operating voltage on the line. Thus a motor-generator set with shunt-wound generator, special control features and other characteristics described below was selected to meet the demands imposed upon this particular station.

The new substation is located at the bay end of the 2-mile fill mentioned above and is practically surrounded by salt water. The floor level is 7.7 ft. above normal high-tide level. This location necessitated great care in the construction and installation to combat and overcome the effects of salt water and salt air. Earthquake hazard also was given proper consideration in the design, construction and support of the building. The structure itself is of reinforced concrete and rests on concrete piling. The piling was driven practically to the point of refusal into the hardpan underlying the surface mud; driven until 32 blows of the 5,000-lb. driving hammer sank a pile but 1 in. The final length of pile was between 30 and 35 ft.

As indicated in Fig. 1 the building is unique in its simplicity and in its system of ventilation. Three sets of louvres, one just above the floor line, one just below the coping and a third in the monitor roof, provide an abundance of fresh air and excellent circulation. Provision is made for the future installation of forced ventilation when that expedient shall be necessary to delay the action of the temperature-overload feature of the automatic equipment.

Equipment

All equipment was furnished by the General Electric Company. The rotating machinery consists of a 1,500-kw., 600-r.p.m., 600-volt generator directly connected to an 11-kv. synchronous motor. (See Fig. 2.) Power is selected automatically from either one of two incoming 11-kv. lines. Two sets of disconnecting switches are installed in each line so that either one may be used as the preferred or the emergency line. The equipment is set up to operate normally on the line designated as the preferred line.

Safety to life and limb was kept in mind in the design of the high-tension structure. A barrier wall was carried up to a height of 5 ft. in front of all of the 11-kv. risers. This prevents accidental contact with the risers. Openings to the horizontal bus compartments are closed with transite covers held in place by phosphor-bronze springs. The bus and switch structure is of non-reinforced concrete. With the exception of the slabs used for the horizontal compartments the structure is monolithic. The central longitudinal wall is extended upward with transite inserts to act as barriers be-

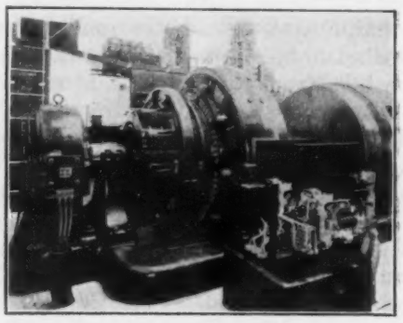


Fig. 2. Motor-generator set; high-speed d.c. breakers in foreground, instrument board in background. Key System substation. Photo courtesy G.E. Co.

tween the line and the load side of the H-type oil circuit breakers. Thus each terminal of these breakers is enclosed in a compartment by itself, reducing the fire and arc-over hazard. (See Fig. 3.)

Above the gallery floor the arrangement of switch cells with rigid structures at the ends permits the H-type oil breakers to be installed in compartments which are open on both sides. This markedly improves the maintenance conditions. The north rigid cell contains the 3-phase power transformer that supplies the control-power generator and the reverse-phase voltage relay. The south rigid cell encloses a single-phase K-132 oil circuit breaker connected to a 100-kw., 11/2.3-kv.

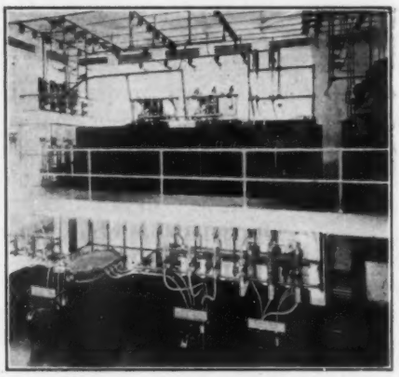


Fig. 3. Bus structures and equipment. Individual switch cells above and a.c. bus compartments immediately beneath. Three-phase power transformer appears in left foreground. Key System substation. Photo courtesy G.E. Co.

transformer that supplies lighting service to the pier terminal. This switch is automatic reclosing to re-establish service three times if opened on short-circuit; the switch automatically locks out after the third operation.

All control wiring in the station is lead-covered cable and is carried in a continuous pit which runs from the switchboard at the west side of the building to the east wall. From this pit fiber conduits branch out to the various devices. This arrangement was adopted to avoid trouble in the possible event of water coming into the building due to freak storm or tide conditions.

Operating Features

The equipment is designed to operate continuously under a 150-per-cent load for a maximum of 2 hrs.; and to operate for 1 min. at 300 per cent load.

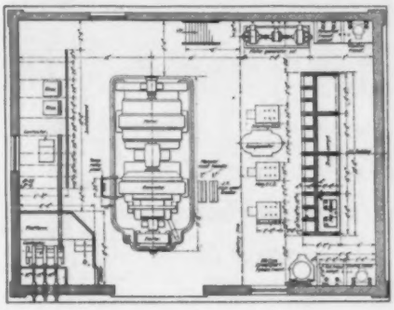


Fig. 4. Floor plan of Key System automatic substation.

Constant voltage is maintained on the station d.c. bus for all loads up to and including the 300-per-cent load, provided the temperature limit of the machine has not been reached.

Temperature relays control the duration of overload according to the temperature of the machine. For example, assume a load demand which throws a 300-per-cent load on the machine. Under this condition the machine will pick up this amount of load and carry it until the temperature rises to a predetermined value, at which point a thermal relay operates and automatically causes the machine load to drop to 150 per cent. If the current remains at the 150-per-cent point until the machine temperature rises to a second predetermined value another thermal relay acts to cause the load on the machine to be reduced to 100 per cent. If conditions are such that the generator temperature continues to rise with only 100 per cent load on the machine, a third thermal relay will operate to shut down and lock out the machine. This latter step is designed in this way because only under some abnormal condition will the machine temperature continue to rise with only 100 per cent load on the machine.

Another condition that is met by the apparatus is that if, after the machine has been limited automatically to the 150 or the 100-per-cent load, the temperature of the machine drops sufficiently the control apparatus will operate to permit the machine again to pick the next higher step of load until temperature values of the generator again cause a restriction as described in the above paragraph. In this way varying conditions are met by the equipment in such a way as to protest the equipment and at the same time meet the maximum power demands during the heaviest peak-load periods.

Control of the machine at the present time is effected through an Anderson time switch. This switch now is set to take care of the normal daily peak demand periods, from 6:15 a.m. to 9:45 a.m. and from 4:45 p.m. to 7:45 p.m. Load regulation during the periods of machine operation is as described in the foregoing paragraphs.

Emergency remote control is provided whereby the machine may be cut into operation at times other than those normally handled by the time switch. Control wires are strung from the station out to the pier terminal dispatcher's office. By means of these the dispatcher at will may cause the motor-generator to start up, come on the line, and take care of any unusual power demand that might arise. Stopping of the machine also may thus be controlled. The apparatus is so arranged that, should he so desire, the dispatcher may start the machine over the remote control and hold it in operation until the time that the time switch normally would start the machine and then cut off his remote control and leave the machine operating on the time-switch control, to be shut down by the switch at the predetermined time. In a similar manner the dispatcher may cause the machine to continue to operate after the time switch normally would cause the machine to shut down.

Voltage Regulation

A small motor-generator set provides voltage regulation. This set is arranged to boost or buck the field of the main d.c. generator, depending upon the excitation of the boosting and bucking fields of the small regulating generator. The boosting field is connected continuously to the 125-volt control-power generator and the bucking field is connected so that it may be shorted out by one of the automatic contactors when conditions warrant.

This combination is controlled by the potential-balancer relay, one coil of which is connected across the machine potential and the other coil of which is connected across the bus potential. While machine voltage is below that of the bus the relay operates to maintain the bucking field shorted out by the aforementioned contactor. When the machine voltage rises to a value 5 per cent above that of the bus the balancer relay operates to permit the cutting in of the bucking field on the control generator, acting to reduce the generator voltage. Through this action the machine voltage is maintained at a value about 5 per cent above that of the bus. A set of relays connected across the regulating generator act to prevent shunting; the relays operating at a frequency comparable to that of a Tirrill regulator.

High-Speed Breakers

Two JR high-speed breakers are connected in parallel in the negative lead of the main generator; each is bridged by a resistance. Under short-circuit conditions these breakers open to the limit of travel in 0.015 sec., cutting in protective resistance. This resistance reduces the current to a value within the commutating value of the generator. The operation of the high-speed breakers causes the opening of the bus breaker on the positive side of the machine.

Protective Features

The equipment is capable of operating automatically to provide against:

1. Overspeed.
2. A.c. undervoltage.
3. A.c. overload.
4. Motor field failure.
5. Overheated bearings.
6. Wrong polarity.
7. Single and reverse phase starting.
8. Overheated a.c. machine windings.
9. D.c. reverse power and underload.
10. D.c. overvoltage.
11. D.c. ground or flash-over.
12. D.c. undervoltage.
13. Single, unbalanced or reverse phase operation.
14. Undervoltage connection to the d.c. bus.
15. Sudden increase of feeder current.
16. Reclosing feeder on short circuits or severs overload conditions.
17. Overheated d.c. machine windings.

Load regulation is accomplished through the devices operating according to the temperature of the d.c. windings.

Copper Saving

Addition of this station permitted the removal of $11,000 worth of copper feeder cable; decreased the feeder losses in this particular section from 22 per cent to 9.6 per cent; raised the operating voltage available to this section of track, increasing train speeds; and increased the track capacity in this congested territory by 11 per cent. The station has been in operation but a short time but already has demonstrated its ability to meet all design requirements.

The installation was designed and performed under the general direction of H. P. Bell, the chief engineer of the transit company. F. M. Morgan, the construction engineer of the company, had complete field charge of construction and erection work.

Indoor Regulators for Outdoor Substation Jobs

By G. A. FLEMING, Engineering Department, Southern California Edison Company, Los Angeles.

Frequently it is desirable to install an induction-type voltage regulator out-of-doors when only indoor type units are in stock or readily available.

The Southern California Edison Company has met this problem by designing a metal cover that will fit the 3-phase regulators of different manufacturers. The illustrations show two types or sizes, one for 4-kv. regulators, the other for 11-kv. or 15-kv. use.

The regulators in the 4-kv. installation form the heart of a small and very simple substation that has been developed to care for relatively unimportant loads in new or rapidly growing districts. The equipment is all in accordance with system standards and the layout is so simple that it can be erected quickly and then moved with small loss when the load justifies a more permanent and reliable type of station. For installations of this character it has been especially desirable to use regulators from stock even though they were of the indoor type.

The illustrations show the manner of carrying the conductors through bushings in the cover and also the general type of the cover used. The

upper part is sheet-iron with louvres on the side and the lower part is of screen to provide ventilation for cooling. The contact-making voltmeter and compensator coil are mounted in the housing provided for meters.

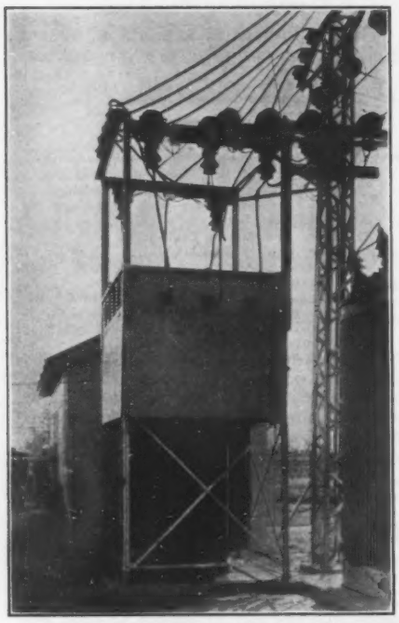


Fig. 1. **Typical installation of indoor regulator for outdoor service, Yucaipa substation, Southern California Edison Company.**

The 11-kv. regulator shown is to control one of a group of feeders. The rack is arranged to allow the installation of a regulator on any circuit with a minimum of work. Each regulator is a unit by itself and may be cut in or out by means of a rather unique arrangement of the two single-throw disconecting switches shown above the regulator. By operating the blade of the righthand switch as though it were a double-throw unit the regulator is cut out and by-passed.

Explosives Used to Dig Pole Holes Economically

By J.R. CRAVATH, Consulting Engineer, San Francisco.

Pole-line extensions on the property of the Giant Powder Company, Giant, Calif., presented an opportunity to try out the blasting method of digging pole holes. The occasion of the extensions was the establishment of a black-powder plant on the company's property, the precautions incident to such a plant necessitating its location remote from existing plants. The line job afforded a chance to try the blasting method on a somewhat larger scale and under more favorable conditions than generally have existed heretofore where blasting for power-line poles has been practiced.

About 45 holes were so blasted on this job. The location of the lines is in a large field near San Pablo Bay, and the soil at the time the work was done was baked very hard. The soil was practically free from rock and small stones and there were no water pipes or other underground construction to avoid or preserve.

Adobe soil such as this and when dried out as this was is very hard digging. The contract for the electrical construction of the black-powder plant was let to the Pioneer Electric Company of Richmond. It was contemplated originally to dig these holes by hand, but the allowance the contractor was willing to make for the omission of hole-digging was sufficient to induce the Giant Powder Company to take back this part of the work and do it by blasting. The net result is considered by those connected with the

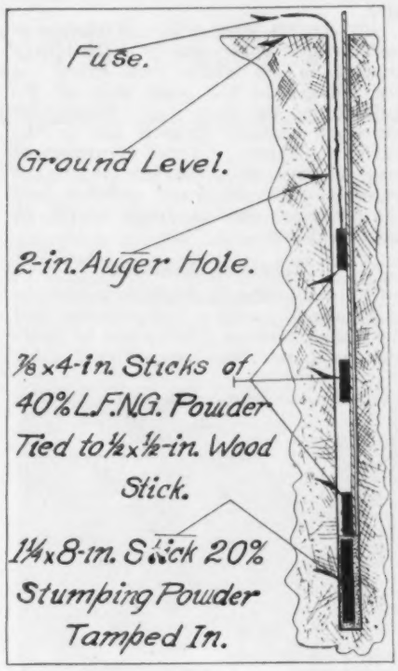

Fuse.
Ground Level.
2-in. Auger Hole.
⅞ x 4-in. Sticks of 40% L.F.N.G. Powder Tied to ½ x ½-in. Wood Stick.
1¼ x 8-in. Stick 20% Stumping Powder Tamped In.

Fig. 1. Sketch showing placement of one whole stick and three half sticks of explosive to prepare 6-ft. hole in adobe soil.

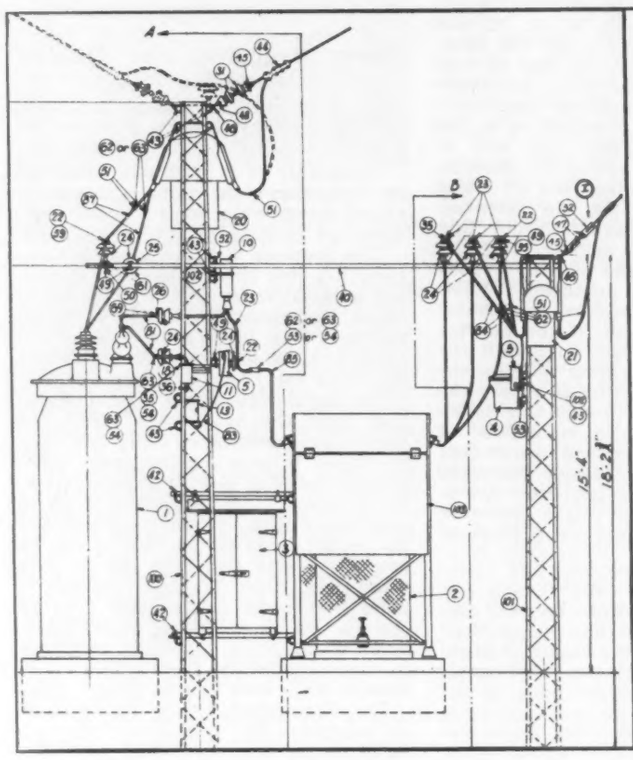


Fig. 2. Design details of 4-kv. outdoor installation of indoor regulator, Southern California Edison Company.

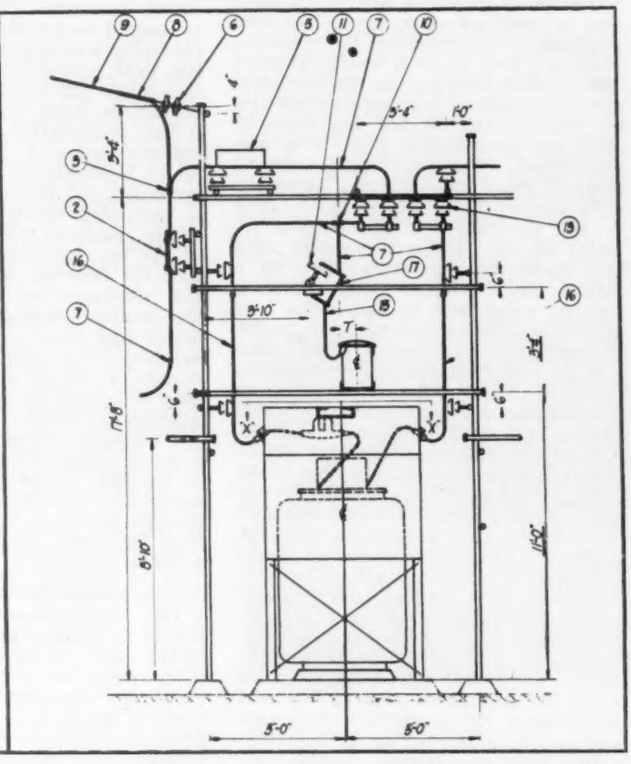


Fig. 3. Details of 11 and 15-kv. outdoor installation of indoor regulators, Southern California Edison Company.

work to have been a considerable saving over the other methods which were feasible for this job. Therefore, the method should be of interest to all who are doing work under similar conditions.

The following method was used. A 2-in. hand auger was used to bore a hole to a depth of 5 ft., as shown in Fig. 1. Sticks of dynamite then were tamped in or tied to a wood stick and sunk into the hole as described later so that the proper amount and kind of dynamite was placed at the proper depths from the surface. At the bottom end of the hole was tamped a 1¼ x 8-in. stick of 20-per-cent L. F. stumping powder. Sticks of 40-per-cent L.F.N.G. powder measuring ⅞ x 8-in. were cut in half and three of these half-sticks ⅞ x 4 in. were tied to the wood stick at 9 in. intervals about as shown in Fig. 1. A cap was placed in the top stick with a fuse long enough to reach to the top of the ground.

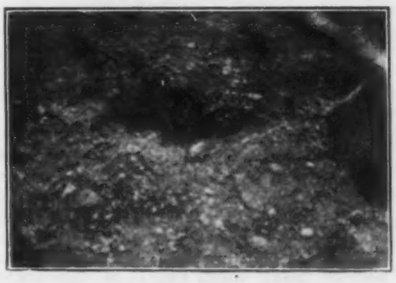


Fig. 2. Appearance of ground surface after explosion; ground loosened.

It will be seen that most of the explosive was considerably below the surface of the ground. As a result, when the charge exploded very little dirt was thrown up. A little heap of loose dirt or sometimes simply a patch of loose dirt level with the ground was all that marked the place where an explosion occurred, as shown in Fig. 2. This loose dirt at the surface was removed easily with a shovel. Below it were found a series of pockets where the four powder sticks had forced outward the dirt opposite each. Between these pockets was loose dirt which also was taken out easily with a shovel and a post-hole digger. Figure 3 shows a completed hole. Pockets were not all the same size. The slow powder at the bottom blew a pocket about 18 in. across while the three pockets above it were about 12 in. The openings between pockets, being in loose dirt, naturally varied in diameter.

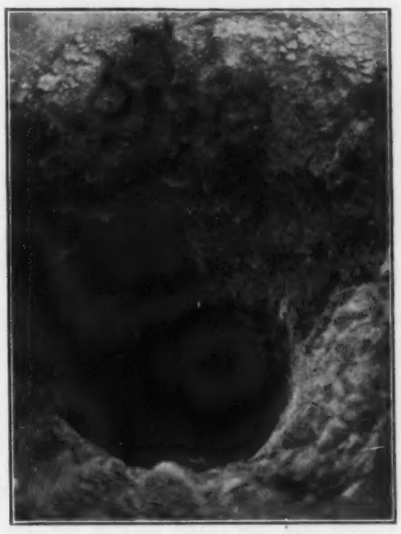


Fig. 3. Completed hole as finished with only a shovel and a post-hole digger.

For soil conditions like those described and with a limited number of holes to be dug the process has proved very economical. One experienced powder man and two helpers can sink the auger holes, fire the shots and clean up ready for setting poles at the rate of four holes per hour. About ten cents worth of powder is required for each hole. The holes on this job were mainly for 30-ft. poles.

This method seems to have a certain field in which it has advantages over the other two common methods of digging; that is over hand digging and machine digging. Where a large number of holes are to be dug on one job in an accessible place the digging machine with its pole-erection features offers the lowest cost when the combined processes of digging and erecting are considered. Blasting undoubtedly is cheaper than hand digging. It limitations are that it cannot be used near underground pipes, ducts or foundations. On occasional, scattered jobs, the amount of work at one place may not justify the precautions necessary in the transportation, handling and use of explosives. Also in some soils where large stones are likely to interfere with the use of the hand auger in boring for the placing of the charge the blasting process is shut uot. The noticeable effect of the explosion extends about 2 ft. through the ground outside the hole and probably it is unwise to use charges of the kind herein described within 4 ft. of pipes or foundations. Outside of the limitations named there appears to be a considerable field for this method.

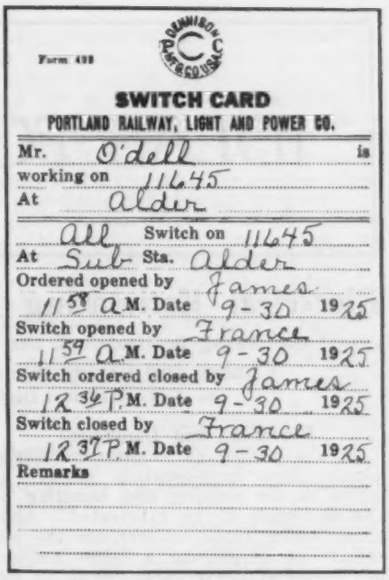
Switch Safety Tags Provide Permanent Record

By W. C. FOSTER, Assistant Operating Engineer, Portland Electric Power Company.

Safety is engendered by the Portland Electric Power Company through the use of standardized tags for labeling switches out of service for repairs. Switches on any line or equipment opened and ordered held for workmen are tagged in the station by the station operator with a special red tag. The front and reverse sides of this tag are shown in Figs. 1 and 2. It may be noted that on one side of this tag is space providing for a complete cycle of operations for a switch. This gives the names of all involved in the transaction and serves as a permanent record thereof.

When the switch finally is ordered cleared and closed the operator notes on the tag this final information and then sends the tag to the office of the operating engineer for inspection and filing.

Pole-top switches are tagged in a similar manner with a large red metal tag. On this tag are the words "Hold Switch Open." The tag is placed by the lineman opening the switch.



Form 431

SWITCH CARD

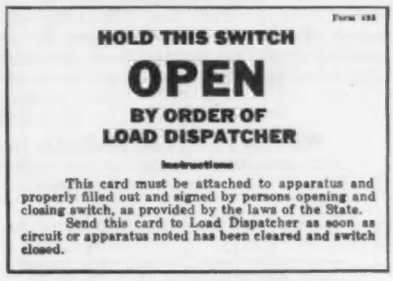
PORTLAND RAILWAY, LIGHT AND POWER CO.

Mr. O'dell is
working on 11645
At Alder

All Switch on 11645
At Sub Sta. Alder
Ordered opened by James
11 58 A.M. Date 9-30 1925
Switch opened by France
11 59 A.M. Date 9-30 1925
Switch ordered closed by James
12 34 P.M. Date 9-30 1925
Switch closed by France
12 37 P.M. Date 9-30 1925
Remarks

Fig. 1. Face of switch tag.

In the dispatcher's office another tag is used to give an indication on the system diagram that is parallel to that given at the switch by the fore-going tags. This tag, shown in Fig. 3, is pinned to the system diagram at the point representing the switch in question. It bears such information as will identify the condition prevailing. This same tag is used to indicate to the dispatcher all special conditions on the system that might affect operation.



Form 431

HOLD THIS SWITCH

OPEN

BY ORDER OF
LOAD DISPATCHER

Instructions

This card must be attached to apparatus and properly filled out and signed by persons opening and closing switch, as provided by the laws of the State.

Send this card to Load Dispatcher as soon as circuit or apparatus noted has been cleared and switch closed.

Fig. 2. Reverse of switch tag.

Fig. 3. Tag used on dispatcher's board to indicate special conditions at definite locations. Typical application of grounded-feeder indicator.

IDEAS FOR THE CONTRACTOR

Electrical Estimating for the Contractor—XIV

Continuing a Study of the Uses for Conveyors and Power Chains and Giving Formulas to Estimate Problems

By J. R. WILSON*, Quality Electric Works, Los Angeles

Elevators and Conveyors

In the design of modern industrial plants first consideration always is given to the routing and handling of the materials to be fabricated. Anything which tends to decrease the necessity of employing a large amount of "common labor" also tends to decrease "labor turnover." It is a fact well known in industry that "common labor" is one of the most unstable and unreliable commodities with which plant managers have to contend.

Mechanics who have spent years in learning their trades are not so prone to sever their connection with a firm if the working conditions are at all satisfactory. But the "floating element of common labor" cannot be depended upon, no matter how desirable the working conditions may be made.

In these days of machinery and high-speed production a plant designed along those lines soon would be in the hands of a receiver. The modern demand for speed in production has been met by the use of conveying and elevating machinery, and some types of this equipment have been developed to a wonderful degree of efficiency.

The use of conveying and elevating machinery usually is specified in the layout of any modern plant, regardless of the nature of the product. Typical examples of some of the industries in which this type of equipment is depended upon largely for doing the heavy work are ice plants, sand, gravel and rock plants, packing houses, flour mills, mines, paper mills, power plants, sugar factories, glass plants and canneries.

Table A

Working Factors for Malleable Iron and "EC" and "SS" Class Steel Chains

Number of Teeth	Chain Speeds—Feet Per Minute						
	100	200	300	400	500	600	700
6	7.0	9.0	14.0	20.0	....	....	....
7	6.6	8.5	12.8	18.0	....	....	....
8	6.4	8.2	12.0	17.0	25.0	....	....
9	6.1	7.8	11.5	16.0	22.0	....	....
10	5.9	7.5	11.0	15.4	20.6	....	....
11	5.7	7.3	10.5	14.9	19.6	25.0	....
12	5.6	7.1	10.2	14.4	18.8	23.4	....
13	5.5	7.0	10.0	14.0	18.2	22.3	....
14	5.4	6.9	9.8	13.7	17.7	21.5	27.0
15	5.3	6.8	9.5	13.4	17.2	20.9	25.4
16	"	6.6	9.3	13.2	16.8	20.3	24.5
17	"	6.6	9.2	12.9	16.4	19.9	23.7
18	"	6.5	9.1	12.7	16.0	19.4	23.1
19	"	6.5	9.0	12.5	15.8	19.1	22.6
20	5.3	6.5	9.0	12.3	15.6	18.8	22.2
21	"	6.5	8.9	12.2	15.3	18.5	21.8
22	"	6.4	8.9	12.1	15.2	18.2	21.6
23	"	"	8.8	12.0	15.0	18.1	21.3
24	"	"	8.7	11.9	14.8	17.9	21.1
25	"	"	8.7	11.8	14.7	17.7	20.9
26	"	"	8.6	11.7	14.5	17.6	20.7
27	"	6.3	8.6	11.7	14.3	17.4	20.5
28	"	"	8.6	11.6	14.2	17.3	20.4

Number of Teeth	Chain Speeds—Feet Per Minute						
	100	200	300	400	500	600	700
29	5.3	6.3	8.5	11.6	14.1	17.2	20.3
30	5.2	"	8.5	11.5	14.0	17.1	20.2
31	"	"	8.5	11.5	13.9	16.9	20.1
32	"	"	8.4	11.4	13.8	16.8	19.9
33	"	"	8.4	11.4	13.7	16.7	19.7
34	"	6.2	8.4	11.3	13.6	16.6	19.6
35	"	"	8.4	11.2	13.5	16.5	19.5
36	"	"	8.3	11.1	13.4	16.4	19.4
37	"	"	8.3	11.0	13.3	16.3	19.3
38	"	"	8.3	10.9	13.2	16.2	19.2
39	"	"	8.2	10.9	13.1	16.1	19.1
40	5.1	6.1	8.2	10.8	13.0	16.0	19.0
41	"	"	"	10.7	12.9	15.9	18.9
42	"	"	"	10.7	12.8	15.8	18.8
43	"	"	8.1	10.6	12.7	15.7	18.7
44	"	"	"	10.5	12.6	15.6	18.6
45	"	"	"	10.4	12.5	15.5	18.5
46	"	"	"	10.3	12.4	15.4	18.4
47	"	"	"	10.2	12.3	15.3	18.3
48	"	"	"	10.2	12.2	15.2	18.2
49	"	"	"	10.1	12.1	15.1	18.1
50	5.0	6.0	8.0	10.0	12.0	15.0	18.0

In the days before the invention of so much labor-saving machinery the handling of the incoming raw materials and finished product between the receiving department, the machines, and the shipping department was dependent wholly upon "common labor." Hand-trucks and wheelbarrows played a large part in the scheme of plant operation, and the propelling force was furnished by the muscles of laborers.

In fact, there is hardly an industry which can be mentioned in which this type of equipment would not show a decided saving in cost of production. Mechanical engineers recognize this fact and their recommendations for the use of modern handling equipment are limited only by the amount of money their clients have to spend on this item.

Therefore, the electrical estimator who receives a set of plans for a modernly designed plant will not be required to make recommendations along this line. But with the previously mentioned desire for speedy production many managers of the older plants now find themselves unable to meet present competition. Their only hope in order to stay in business is to modernize their plants to the extent within their means.

Keeping in mind the statements previously made here, it readily will be seen that the logical method is first to consider ways and means of reducing the costly handling of the raw and finished product. The estimator who is equipped to make recommendations and to carry them out to a successful

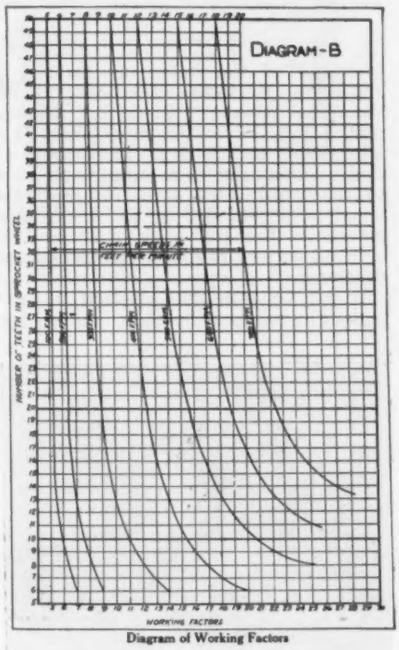


Diagram of Working Factors

conclusion has an opportunity of acquiring a great deal of additional business for his firm.

This field is so large in any industrial district that no estimator is justified in saying, "There ain't no business." The business is always there—for the man who will go out after it. The prospective customer may not be able to spend the money at the time figures are presented to him but the seed sown will give him food for thought and will bear fruit at the time least expected.

With the above thought in mind certain tables and data pertaining to this type of equipment are presented in this article with the hope that they will prove of value to those estimators who desire to enter this field but have not had experience along this line. Time can be very well spent also in inspecting modern plants which make use of conveying and elevating equipment. Any additional information re-

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Reference Table C

Diameter in Inches Expressed in Feet of Circumference
(Diam. in Inches × .2618 = Circum. in Feet).

Diameter Inches	Circum. Feet	Diameter Inches	Circum. Feet	Diameter Inches	Circum. Feet	Diameter Inches	Circum. Feet	Diameter Inches	Circum. Feet
1	.26	21	5.50	41	10.73	61	15.97	81	21.21
2	.52	22	5.76	42	10.99	62	16.23	82	21.47
3	.79	23	6.02	43	11.26	63	16.49	83	21.73
4	1.05	24	6.28	44	11.52	64	16.76	84	21.99
5	1.31	25	6.55	45	11.78	65	17.02	85	22.25
6	1.57	26	6.81	46	12.04	66	17.28	86	22.51
7	1.83	27	7.07	47	12.30	67	17.54	87	22.78
8	2.09	28	7.33	48	12.57	68	17.80	88	23.04
9	2.36	29	7.59	49	12.83	69	18.06	89	23.30
10	2.62	30	7.85	50	13.09	70	18.33	90	23.56
11	2.88	31	8.12	51	13.35	71	18.59	91	23.82
12	3.14	32	8.38	52	13.61	72	18.85	92	24.09
13	3.40	33	8.64	53	13.88	73	19.11	93	24.35
14	3.67	34	8.90	54	14.14	74	19.37	94	24.61
15	3.93	35	9.16	55	14.40	75	19.63	95	24.87
16	4.19	36	9.42	56	14.66	76	19.90	96	25.13
17	4.45	37	9.69	57	14.92	77	20.16	97	25.39
18	4.71	38	9.95	58	15.18	78	20.42	98	25.66
19	4.97	39	10.21	59	15.45	79	20.68	99	25.92
20	5.24	40	10.47	60	15.71	80	20.94	100	26.18

To find the required pull (or working strength) in the chain, use the formula:

$$\text{Chain Pull in Pounds} = \frac{\text{Horse Power} \times 33{,}000}{\text{Chain speed in feet per minute}}$$

quired always can be obtained from the manufacturers of such equipment.

Most of the different types of this machinery consist basically of sprocket wheels, chains and buckets, or drive wheels, rollers and canvas, rubber or leather belts. To make an intelligent estimate of probable saving to be expected by installing the necessary equipment, and the cost of such installation, the estimator must obtain reliable information regarding several factors. These may be stated as follows:

1. Typical characteristics of materials to be handled—sizes of largest and smallest pieces or articles, and weights per package or cubic foot.

2. Capacity—total quantity handled per working day and maximum hourly rate.

3. Points and manner of delivery to conveyor and discharge from it.

4. What parts of the supporting structure, hoppers, bins (or other appurtenances to the actual machinery), are to be included in the estimated cost of the installation.

5. If driven by separate motor, what horsepower and speed? If driven from a present line shaft, what speed and diameter?

6. Will customer furnish labor for erection (under contractor's supervision), or must contractor furnish all labor?

Always make at least rough sketches (on the job) of such obstructions as are apparent. Put down such figured dimensions as it is possible to obtain. These data will prove of value later, when making the drawings for submission to the prospective customer.

If there is any question regarding any part of the installation have it settled before the contract is signed, or have a detailed statement regarding future disposal of the question. Attach this statement to the contract and have it separately signed by the customer. Have all working drawings signed by the customer and keep copy in your files until the contract is completed.

This in no way reflects on the honesty of the customer or of the contractor, but is a protection to both parties. It is purely business and is the procedure followed by all reputable architects and engineers.

To provide a logical sequence of discussion we will divide the conveying mediums into two classes: chain conveyors and belt conveyors, and consider the data pertaining to each class separately.

Power Chains

A chain must have two paramount qualities, durability and immunity from breakdowns. One well known manufacturer maeks twenty-seven different types of power chains, each type designed to meet some specific condition of operation. The success of the installation depends absolutely upon the selection of the correct chain, also the chain must be run on sprocket wheels which fit it correctly.

The ratio, or "working factor" between the "ultimate strength" of a chain and the "working strength," "load," or "chain pull," depends upon the speed of the chain and the size of the wheels on which it runs. The engagement of each chain link with the tooth of the sprocket wheel is ended by a certain degree of shock, this being intensified as the speed is increased. On comparatively high speeds a chain of relatively higher ultimate strength should be chosen.

The number of teeth in a wheel affects the life and service of a chain in several ways. A chain is subject to:

1. Internal wear in the joint.
2. External wear from contact with teeth and rim.
3. Injury from shock or impact.

Items 1 and 2 depend upon pull, speed, and number of teeth. Item 3 depends upon the chain pitch and wheel diameter, that is, the number of teeth.

For wheels of few teeth the safety factor must be higher to provide against the extra shock and wear. The impact of a link traveling 100 ft. per min. is 36 times as much as on an 8-tooth wheel as on a 50-tooth wheel. The working factor for a chain running at 400 ft. per min, over a 6-tooth wheel is larger than for the same chain running 700 ft. per min. over a 50-tooth wheel and therefore requires a chain of greater strength to do the work. In comparing two chains of the same strength the one with the shorter pitch is preferable for driving purposes.

Table A and Diagram B give some valuable information pertaining to power chains and are authentic having been prepared by an authority on chains and their application. Table C will be found convenient for figuring chain speed in feet per minute from the diameter in inches. Table E gives the ultimate strength of some popular conveyor chains.

To find the working strength, divide the figures given in Table E by the working factors given in Table A or Diagram B; for instance, the ultimate strength of No. 77 chain is given as 3,600 lb. If the small wheel of the drive is 11¾ in. diameter and the speed is 100 r.p.m. the chain speed would be about 300 ft. per min.

If we assume a 16-tooth wheel, by reference to Table A we find the corresponding factor, at 300 ft. per min., to be 9.3. The proper working load, therefore, would be $\frac{3{,}600}{9.3} = 390$ lb. If the same wheel were 6-in. diameter, 8-tooth, and made 200 r.p.m., the chain speed would be about 300 ft. per min., but the factor would be 12. The proper working load (for the same chain) would be

$$\frac{3{,}600}{12} = 300 \text{ lb.}$$

Always use the factor corresponding to the smaller wheel of the drive. Try to avoid the use of wheels having more than 50 teeth, or less than 10 teeth. Do not use a closer center distance for shafts than the sum of the diameter of larger and half the diameter of the smaller wheel.

To select a chain to transmit a given horsepower proceed as follows: knowing the r.p.m. of the shafts, assume wheel diameters which will furnish the desired speed ratio and an economical chain speed (not over 400 to 500 ft. per min.) Notice in Table A or Diagram B that the working factors increase rapidly below 12 to 16 teeth. Assume for the smaller wheel about this number of teeth, combine with a short pitch chain of proper strength, working out the problem as shown in the following examples.

Example 1

Transmit 4 hp. from 60 r.p.m. shaft to 20 r.p.m. shaft.

Trying 16 teeth for small wheel (to avoid a large working factor) and 48 teeth for larger wheel (as coming inside the 50-tooth limitation) we find the series of wheels for 2.609-in. pitch chains (Table E) gives a diameter of 13¼-in. for the small wheel and 40-in. of 208 ft. per min. The chain pull figures $\frac{4 \times 33{,}000}{208} = 635$ lb., and the combination of chain speed and number of teeth calls for a working factor

of about 7. The minimum required ultimate strength will be 635×7=4,445 lb., and this requirement will be met by chain 78 (listed in Table E) having a strength of 4,900 lb.

Example 2

Transmit 10 hp. from 125 r.p.m. shaft to 100 r.p.m. shaft.

Assume 16 and 20 teeth to secure an exact speed ratio with wheels of moderate size. The series of wheels for 3.075-in. pitch chains give 15¾-in. diameter for small wheel and 19¾-in. for large wheel, with chain speed of 515 ft. per min. Chain pull figures 640 lb. and number of teeth indicates a working factor of 17½. The ultimate strength required is 640 x 17½ = 11,200 lb., and Table E shows E.C. 103 chain to have a strength of 11,500 lb.

For comparison let us try out the series of wheels for 2.609-in. pitch. Using the same number of teeth, we get 13¼-in. and 16¾-in. diameters, giving a chain speed of 435 ft. per min. approximately a chain pull of 760 lb., working factor of 14½, with an ultimate strength requirement of about 11,020 lb. Chain E.C. 88 or S.S. 433 will handle this, and at the lower speed will be preferable under ordinary conditions.

Drive chains and wheels should be lubricated regularly. Run drive chains with the hook end or head end of the link leading. On long vertical drives a tightener should be used on the slack side of the chain. On long horizontal drives a plank runway may be used to support the chain, thus avoiding flapping and jerking.

Conveyor and Elevator Chains

Conveyor chains generally run 100 ft. per min. or less, seldom over 150 ft. per min. For centrifugal discharge elevators chains should run at the minimum speed which will give proper discharge. This varies with diameter of head wheel and the projection of the bucket. The proper r.p.m. of the head wheel is given by the formula:

$$\text{r.p.m.} = \frac{153}{\sqrt{r}}$$ in which r = distance in inches from center of head shaft to center of gravity of material in the bucket. Table D is based on this formula and is correct for average conditions. For elevators using head wheels less than 21-in. diameter and buckets having more than 4-in. projection, use the formula for best results.

The pull in a vertical elevator chain equals: the weight (in pounds), of chain and buckets on the rising side plus weight of material in the buckets plus an allowance for picking up the material at the foot of the wheel. Formula E gives an approximation for the strain due to picking up coal, ashes or similar lump materials in elevators running at speeds given in Table D.

Formula E

Pull (in pounds) due to pick up = weight of material carried by one foot of elevator × diameter of foot wheel in inches.

Example: Centrifugal discharge elevator has 24-in. diameter foot wheel. Buckets carry 7 lb. of coal per foot of chain. Pull due to pick up is 7 × 24 = 168 lb.

For fine, dry, free-flowing materials use one-half the values given in formula E.

Pull in a conveyor chain cannot be covered by a general formula. Each installation is a problem in itself, and the manufacturers of this type of chain should be consulted. After the pull is known and the speed has been determined, use Table A (or Diagram B) as previously explained, to obtain the right working factor. Multiply chain pull by the factor to obtain the proper ultimate strength of the chain.

The chain must be strong enough and the attachment link must be large enough and have spread enough to get a firm hold on the bucket, flight, bar, etc. Chains for double-strand elevators or conveyors must be ordered with the strands matched and tagged if best results are to be obtained. Short flights or slats, or stiff buckets, mounted on two strands of chains work best with swivel attachments. Conveyor and elevator chains should run with the pin end of the link leading.

Sprocket wheels play as important a part as does the chain. Do not buy your chain from one manufacturer and the sprocket wheels from another and except to get a satisfactory drive. This can be done with pulleys and belts, but not with chain drives. The sprocket must fit the chain and often must be ground to secure this fit. A well fitting sprocket wheel is the best investment that can be made.

The writer is indebted to Link-Belt Meese & Gottfried Company for its kind permission to use the tables, formula and other information contained in this article.

Table D

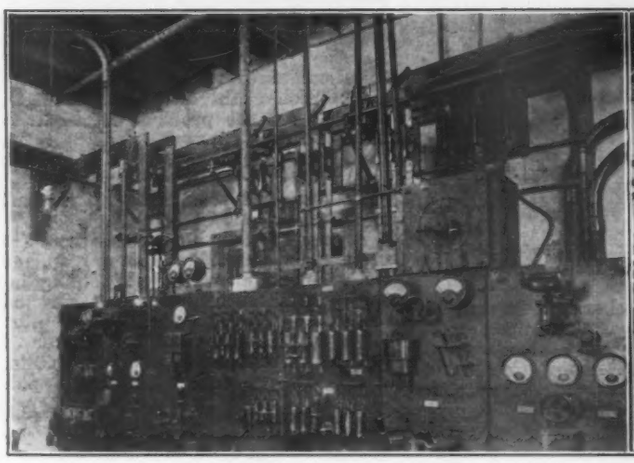
Head Wheels and Speeds for Centrifugal Discharge Chain Elevators

Diameter of wheel, inches	12	15	18	21	24	27	30	33	36	39	42
Revolutions per minute	54	50	46	43	41	39	37	36	34	33	32
Velocity, feet per second	2.62	3.28	3.62	3.95	4.28	4.60	4.83	5.18	5.34	5.62	5.87
Chain speed, feet per minute	157	197	217	237	257	276	290	311	320	337	352

Table E.

Ultimate Strengths in Pounds, of Some Popular Chains of Same Pitches

PITCH 1.654"		PITCH 2.293"		PITCH 2.609"				PITCH 3.075"	
Number	Ultimate Strength	Number	Ultimate Strength	Number	Ultimate Strength	Number	Ultimate Strength	Number	Ultimate Strength
62	3,100	57	2,800	75	4,000	C-188	14,000	103	9,600
462	9,000	67	3,300	78	4,900	788	17,500	4103	22,000
H-62	7,000	77	3,600	88	5,750	EC-88	11,000	C-131	24,000
EC-62	7,000	477	9,600	488	11,000	SS-30½	20,000	7103	30,000
SS-80	12,000	SM-477	7,500	H-74	10,000	SS-88	20,000	EC-103	11,500
SS-378	13,000	SS-506	10,000	H-78	16,000	SS-305	17,500	SS-40	25,000
				Continued in next panel		SS-433	11,500	SS-525	22,000
						SS-733	17,900		



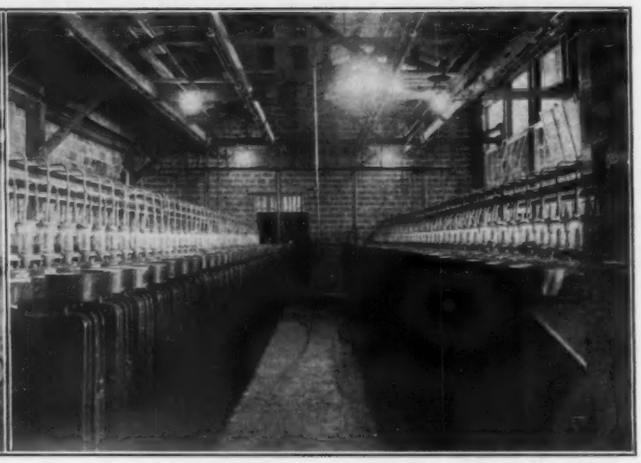


Fig. 1. Main switchboard at the Vegetable Oil Products Company plant showing the copper busing used. Service comes in from right above board; sub-feeds to sub-board on the left. Fig. 2. Two rows of gas cells in which water is broken up into hydrogen and oxygen. The front of the sub-board may be seen in the background.

Old Installation Brought Up to Date by Copper Busing

Electricity has been used for a number of years in the Vegetable Oil Products Company of Wilmington, Calif., in connection with the refining of vegetable oils by means of hydrogen. The primary load in this one plant has been a heavy one, for electricity is used in it to break up condensed water into its component gases, hydrogen and oxygen, the oxygen being sold commercially.

Frank McGinley, Electragist, of the Harbor Electrical Company, Wilmington, recently was asked to bring the installation in this plant up to modern standards, since the switchboard was out of date and the back of it a tangle of wires. Utilizing old equipment whenever possible, and by means of good busing the installation is now one ranking with modern installations of this type.

On the main board, supplying 440-volt service, ¼ x 4-in. copper bus, two pieces bolted together for each of three legs was used. The distribution system is operated at 110 volts, and here, too, ¼ x 4-in. copper bus, three pieces bolted together, are used to distribute to the sub-board. At the main board

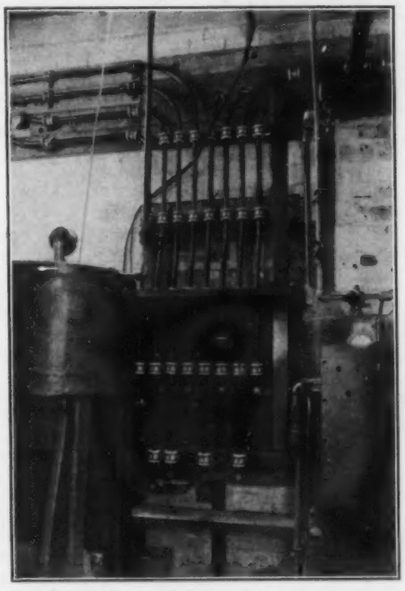


Fig. 3. The sub-board with the door removed. Sub-service may be seen entering at right, insulated.

the bus copper service comes in from above the board from the right. The sub-feed from this to the sub-boards runs off the left. (Fig. 1.)

The sub-board, too, is all bused with copper. (Fig. 3.) The sub-service comes in from the right and is insulated.

The chief load of the plant is in the breaking up of water into hydrogen and oxygen. Feeds from the sub-boards run to two rows of gas cells (Fig. 2) in which this process takes place. The gas cells are connected in series with bus copper. This service is 150 volts, with 50 cells in the bank.

Altogether this plant has a connected load of approximately 1,100 hp. This includes two 300-hp. motor-generator sets.

Unsafe Wiring Checked by New Form Used in Denver

A form just developed by C. F. Oehmler, city electrician in Denver, for inspection and notification of corrections to be made in faulty electrical construction in old buildings is of interest.

One of the inspectors is detailed with one of the assistant fire chiefs from the fire prevention bureau to make a complete inspection of old buildings in a certain area. In checking over the building for all causes related to fire hazards, this form is brought into use when electrical items are encountered. It is made out in duplicate, and the original signed and checked by the inspector is left with the owner or tenant at the conclusion of the inspection. The injunction is that the corrections should be made within 48 hours.

The owner or tenant must then turn the correction sheet over to the electrical contractor who will revamp the job in order that the latter may take out the necessary electrical permit. This allows the inspection department to check up on the man doing the work and also provides a means whereby the job will not be cleared until every correction has been completed.

A green tag, warning against any additions, is used to identify overloaded circuits. "Do not make any additions to the installation until corrected" is the warning given by the tag.

Original

BUILDING DEPARTMENT
CITY AND COUNTY OF DENVER
ELECTRICAL DIVISION

DATE

SURVEY

FIRE

REWIRE

FINAL INSPECTION

No.....

Mr. .....Owner or Agent.

Dear Sir—I have this day inspected premises at No.....St., and find same in unsatisfactory condition, and maintained contrary to ordinances of the City and County of Denver, and a serious fire hazard. You are hereby notified to make the following corrections: .....

X Indicates Defects

10 Floor	9 Floor	8 Floor	7 Floor	6 Floor	5 Floor	4 Floor	3 Floor	2 Floor	1 Floor	Attic	Basement		
												1.	Neutral on 3-wire circuits or 1-conductor on 2-wire circuits without required polarity identification
												2.	Flexible cord, without approved metal armor, used in show windows or show cases
												3.	Lamp cord pendants too long, lamp cord used as line wire, or supported on hooks, nails, etc.
												4.	Wires not properly separated or insulated from metal ceiling, piping, or other conductors
												5.	Wires exposed to mechanical injury
												6.	Splices and joints in conductors not properly soldered or taped
												7.	Non-safety type switches on motors, etc.
												8.	Wires overloaded, or smaller than No. 14 B. & S. gauge
												9.	Insulation on conductors not standard, defective, or not suitable for purpose used
												10.	Wires and conduits running over roofs of buildings not properly supported
												11.	Pendant or portable flexible cord not standard, defective or not suitable for purpose used
												12.	No service cut-out, or cut-outs not properly located or defective
												13.	No cut-out, where change is made in size of wires or cut-out not readily accessible
												14.	Cabinets or cut-out boxes not properly constructed, too small, without door, defective, or not labeled
												15.	Main or branch circuits over-fused or defective
												16.	Non-standard or defective heating appliances motors, generators or switch board
												17.	No service switch
												18.	Service switches not properly installed or not suitable for purpose used or missing
												19.	Non-standard or defective switches or snap switches without sub-base
												20.	Panel or switchboard non-standard or improperly installed
												21.	No lug connections on switches or cut-outs, of over 30-ampere capacity, or connections loose
												22.	Fixtures not properly insulated or permanently grounded or supported
												23.	Metal sockets used in damp or wet places or come in contact with plumbing, etc.
												24.	No vapor-proof globes, or key sockets used, where exposed to inflammable materials or gases
												25.	Electric signs not of approved construction or improperly installed
												26.	Non-standard or defective lamp sockets or receptacles
												27.	Flush switches or receptacles not enclosed in approved steel boxes
												28.	No wire guards on lamps, gas-filled lamps exposing inflammable material
												29.	Wiring in theatre, moving picture show or auto garage not in conduit or metal moulding
												30.	Cut-outs or knife switches, not enclosed in fireproof cabinets
												31.	Non-standard moulding used, or not properly installed
												32.	Moulding used in concealed or damp places, or without proper fittings
												33.	Metal conduit without approved outlet boxes or with boxes not properly located or installed
												34.	Metal conduit or fittings not standard
												35.	Metal conduit or metal moulding not properly bonded or grounded
												36.	Metal conduit not provided with bushing and locknuts, or not properly installed
												37.	More wires than permitted in one conduit, or conduit sizes not in accordance with table on
												38.	Rheostats or motor starting devices not properly installed or constructed, covered or protected
												39.	Transformers not properly installed, motors not properly installed or grounded
												40.	Neutral conductor on low potential circuits not grounded (where required) or improperly grounded
												41	Electric pressing irons or heating devices not properly installed or protected
												42.	Motion picture booth not standard, machine not approved, or without shutter or magazines

Radio .....

(Signed) ..... Deputy Inspector

REMARKS (Approved) ..... City Electrician

THIS NOTICE MUST BE RETURNED WITH PERMIT FOR APPROVAL

Fig. 1. The new form used to indicate defective wiring and require correction as used by the city inspector of Denver, Colo.

BETTER MERCHANDISING

The Trade-in—What To Do With It

Used Appliance Problem Facing Electrical Industry Holds No Terrors for Merchandiser Planning to Meet it

What to do about trade-in appliances—the question which once agitated the automobile industry—is about to descend upon the electrical appliance merchandiser. But as in the case of the automobile, the problem has found its solution in a square facing of the facts and doing something about it.

It is not with any shouting of hosannas that the prospect of the used electrical appliance is regarded, to be sure. The presence of a necessity for disposal of trade-in or second-hand appliances presumes a certain saturation of the market which means downright hard work for the merchandiser. But it is equally true that it doesn't do to let the situation bluff anyone out of good sleep and three square meals a day. Ways have been found in the automobile business to solve the problem. And certainly, if any business has periodically faced saturation points row on row, in full marching order and armed to the teeth, the automobile industry has done just that.

Are they downhearted, the automobile builders? Not as long as the words "improved model" stand the wear and tear of automobile advertisments. This morning's paper announces that somewhere that some one of a dozen—if not all twelve—automobile manufacturers is or are about to start work on a new umpty-ump million dollar spare tire rack factory, just as if no saturation point existed. It doesn't exist for the automobile manufacturer.

The electrical appliance market need have no saturation point either if the industry wrestles with it and shows it which is a better man, the saturation point or the industry.

Taking Away the Iron and Coffee Pot

Not long ago several electrical merchandisers found that they could sell a great many electric irons, percolators, and vacuum cleaners if they offered a dollar for the old sad iron, the old coffee pot, or the old broom or carpet sweeper, in trade for the electrical appliance which was to replace them. It isn't mentioned in any of the accounts of such sales campaigns just what the enterprising electrical man did with the accumulated sad irons, dirty coffee pots and old brooms after they had served as a spectacular window display. More than likely some enterprising junk man was sold a quantity of scrap iron, and the broom handles made good kindling.

But it hardly pays to sell for junk the old vacuum cleaner or the old washing machine. As junk they bring too little to entice the thrifty housewife to part with them, even though a more modern machine could do the work more efficiently. To her they represent some outlay of capital that she would like to realize on the purchase of a new piece of apparatus. If the old machine can be turned in as part of the new investment, the first barrier of resistance is broken down, and the sale is half made. This is a fact that any good salesman knows from experience.

If This Is So, What's To Be Done?

Obviously, if an electrical merchandiser wants to dispose of more new appliances in a market already fairly well supplied with those appliances, he must have two things. These are:

(1) A product which presents an improvement on the existing appliance.

(2) A means of removing the existing appliance from the scene with the least pain.

The manufacturers supply the first consideration. New models are appearing with the frequency of new automobile designs. Great competition in this factor already exists between manufacturers.

But the second consideration is left pretty much up to the electrical merchandiser. That is his problem, in almost every case. It is a test of his shrewdness as a merchandiser to develop some means of sliding the old appliances, out of the household and slipping the new one in gracefully. That is becoming part of the art of selling.

But, what he does with the old appliance after it has been taken in as part payment, "that is the question!" That is a question which requires not only salesmanship, but ingenuity as well as a long list of other pious qualities from forbearance down to tact and back again to diplomacy.

FOR SALE—MISCELLANEOUS

Used
Electric Ranges

ONE Universal cabinet range, 4-top burners, oven and broiler; cost new, $175; used few months; will sell for $100, balance due on account; to appreciate this range you must see it.
RUTENBUR electric range, 3 top burners, elevated oven and broiler; good condition; last for years, $65.
WESTINGHOUSE range, semi-automatic electric range; cost new $135; will sell for $75; a real buy. Call and see it.

Used Laundry Equipment

BLUE BIRD electric washer, good running condition, $55.
WATER POWER washer with wringer used short time; runs and looks like new, $20.
WATER POWER washer, good condition; works fine, $15. A real bargain.
COMBINATION hand wringer and tub stands; used one month, $9.
USED Hot Point vacuum cleaner, runs and cleans well, $10.

Blue Bird Electric Shop
1105 Broadway Main 3003.

A Tacoma electrical merchandiser uses the classified columns of the newspapers with telling effect in disposing of used electrical appliances.

The "Rebuilt" Idea Sells Many Things

Some years ago ingenious merchandisers of certain mechanical goods brought forth the idea of the "factory rebuilt" typewriter, adding machine, etc. Then the used car merchant caught the idea and produced guaranteed rebuilt cars. It is not uncommon to see advertised almost any type of mechanical apparatus that has been rebuilt and put on the market for the thrifty person who would save a little on the machinery he needs or wants. Even houses have been rebuilt recently and have found a good market.

One thing is accomplished by the rebuilt machine. Offering a standard piece of equipment, overhauled and worn parts replaced, and at a price somewhat lower than the price of a new appliance, the range of sale is extended from the class of people who are financially able to purchase such appliances to a much greater class, just on the edge, who would buy if they could get them at less cost. These people will eventually buy new machines, after they have tried and used a good rebuilt machine satisfactorily for some time. They are worth cultivating as future customers.

Already some electrical merchandisers are making use of this idea. The traded-in appliance is given an overhauling and touched up with paint. It is then exhibited in a department set aside for that purpose, where it will not compete with the new machine. It is sold with a guarantee based on its condition and merit, and goes forth backed by the merchandiser's good name.

Feeling that it must take in wood and coal stoves, gas ranges and oil stoves if it were to place a good load on its lines from electric ranges, The

An Exceptional Opportunity to Get a Vacuum Cleaner at a Very Low Price
100 Guaranteed Factory Rebuilt
Electric Vacuum Cleaners
$18.45
for Wednesday Only
These cleaners go on sale tomorrow morning at 8:30. Be on hand early to get your cleaner; the last time we offered these rebuilt machines,they were sold out in short order. And no wonder, for they are the greatest values in vacuum cleaners on the market. You have a choice of well known makes—Hoover, Premier, Ohio, Apex and Eureka. Every cleaner has been thoroughly reconditioned—all worn parts have been replaced and each cleaner is fitted with a new bag. We have tested every machine to be sure it is in perfect running order.
Don't miss this opportunity to get a vacuum cleaner — and avoid the dust and work of sweeping with an old fashioned broom during the hot season. Only a small down payment is necessary with the balance spread out in small monthly payments.
May Be Bought on Easy Terms
Only One to a Customer
Breuner's
Choice of Such Well-Known Makes of Vacuum Cleaners as:
Premier
Eureka
Ohio
Apex
Hoover
Guaranteed Against Mechanical Defects

Rebuilt vacuum cleaners, sold with a guarantee, are disposed of effectively by a large furniture dealer. A big advertisement, reproduced above, was one of the effective sales helps in selling these trade-in appliances.

Washington Water Power Company, as a typical instance of what can be done by careful study and a little daring, devised a novel means of disposing of these trade-ins. (See Journal of Electricity, July 1, 1926, p. 23.)

Coal and Wood Stoves Replaced by Ranges

It took instruction of the salesmen on the appraisal value of old ranges of every type and make. At first the old ranges were brought in to the main office and put on display in the basement of the company's offices. Occasionally a salesman was able to dispose of one where he failed to sell an electric range. Advertisements run in local papers attracted many sales and for a while this method of disposing of them sufficed.

Occasionally a salesman got over-enthusiastic in appraising the value of an old range, however, in his effort to sell an electric range. The problem became more acute with the selling of greater numbers of ranges. The company found itself with a large number of antiques and no market for them. Some were in very bad condition, and it was decided to hire a man to put them in first class condition and then sell them with a year's guarantee.

Repaired and Sold on Terms

Arrangements were made to have the overhauling done on a time-and-material basis. The plan proved so successful that a scheme was worked out to give the entire business to the repair man to handle. He set up a separate store to dispose of these ranges. Salesmen now co-operate with him in setting values on ranges of various kinds taken in. The Washington Water Power Company pays him a fixed charge for cleaning and making repairs on each range. It also stands the cost of repair parts and allows him a 10 per cent commission for selling. He pays the store rent himself.

To sell the ranges he may extend terms without credit approval provided he gets 25 per cent down. If the customer cannot pay that much down he may take up the matter with the company's credit department, and if credit is satisfactorily established, terms are extended over a period not to exceed twelve months. All collections and billing are done through The Washington Water Power Company.

It is to be said for this plan that it works. It not only relieves the company of all responsibility in selling and delivering but it is claimed that it has been the means of getting from fifteen to thirty dollars more for every range than could be secured previously.

Plan Worth the Trying

While the plan just outlined may not work equally well under all circumstances there is much of it that can be adopted in any rebuilt appliance sales plan. More than anything it shows that there is a way out if the electrical merchandiser gives the problem sober thought and takes it in earnest.

The used appliance can be a bother or it can be a source of double income —income from the sale of the new appliance and income from the sale of rebuilt appliance. It all depends upon the way it is regarded. It all depends on the way in which it is attacked and fought out.

The used appliance problem is one which requires above all else what is gracefully called "intestinal fortitude."

"Double Action" Window Sells Washing Machines

Action in a show window always will attract a crowd. And when there is double action there is likely to be a "double crowd." Such was the case, at least, when a northern power company put in a "double-action" display in one of its salesroom's show windows recently.

An electric washing machine was placed on a track in a 12-ft. window in such manner that the casters for the machine served as wheels. The wringer had a web belt, quite broad, running through it. Either end of this belt was attached to a frame that held the webbing at the right height.

On either side, the wringer trip was fastened to a string that was just long enough to permit the machine to glide to the end of the track when the string, fastened at the opposite side, drawn taut, would reverse the machine. The motor on the machine fur-

In its well lighted windows at its Sutter Street offices in San Francisco, the Pacific Gas and Electric Company recently exhibited this display of Savage washing machines, attracting a great deal of attention. This window-display feature is tendered to merchants of various lines of merchandise to demonstrate the effective use of daylight window lighting.

nished the power. All the time the washing machine was traveling back and forth on the track the wringer was in operation.

Two bull terrior dogs seated near the machine imparted the sales message. Said one, breather fashion, "It would sure be a dog's life to do without the Automatic Washer, hey, Beans?" The other replied: "Yes, and think of the good work and speed with which the Automatic does the washing!"

Sales the first day more than paid for the cost of the window out of the profits.

Entire Community Helps to Make Electric Home Display

How A. R. Tanner, General Electric Company salesman located in Visalia, Calif., being himself convinced on the electric home idea, elicited the co-operation of central station, contractor, dealers, jobbers, music and furniture dealers in making the home he was building an electric home display, is an interesting chapter in the story of home electrification.

Deciding to build for himself, Mr. Tanner wanted that home to be thoroughly electrical. The idea occurred to him that he might get the co-operation of the entire community in making his home a model electric home, allowing it to be used as a demonstration of what the complete modern home should be. Although not interested directly in the sale of either electrical merchandise or homes, his work with the General Electric Company being in connection with other lines of material, yet as a member of the electrical industry Mr. Tanner said:

"I felt that I should open my home to the public and contribute what I could to the good of the industry by the education of the public along electrical lines. I have been well repaid by the appreciative attitude shown by those visiting the home."

Visalia, Calif., was given its first electric home demonstration when A. R. Tanner, salesman for the General Electric Company, opened his new home to public inspection in co-operation with the builders, contractor, power company and local furniture, piano and nursery supplies dealers.

The Southern California Edison Company completely furnished the kitchen and contributed the current used during the week of display. A range specialist was supplied by this company to demonstrate in the kitchen. The Visalia Electric Works, which did the wiring, furnished a number of appliances. Two members of the firm were in the home at various times to explain the merits of electrical service to the visitors. Messrs. Wood and Deakin, furniture dealers, completely furnished the home and helped to entertain the visitors also. Wiley B. Allen Company placed in it an electrically driven Ampico piano, which with a Radiola superheterodyne kept the visitors supplied with music. A contralto soloist entertained one evening, too. The California Electrical Bureau furnished the floodlights to illuminate the exterior of the house during the time of exhibition.

Other companies who contributed toward the exhibit, either in display material or in advertising were: K. C. Heath and staff, Fancher Creek Nurseries, Visalia Hohe Builders, Mobert Brothers, A. Dressler, and C. J. Allen, representative of the Pacific States Electric Company.

Co-operative advertising on the home display was run in the papers. During the week of the display over 3,200 people visited Mr. Tanner's home. A number came from surrounding towns; the entire high school from one of the nearby towns came in a body to visit it one afternoon, and at other times individual classes from other schools visited the home.

No attempt was made to commercialize the demonstration. Neither signs, cards, prices nor anything of a commercial nature was exhibited. Each person helping to entertain visitors tried to make them feel at home and tried only to show the advantages of the home electrical. There have been a number of electrical homes, but this is the first instance reported in which one was conducted by someone other than those directly interested in electrical merchandising or home building.

Animated billboard adopted by the Rocky Mountain Electrical Co-operative League to promote better wiring and lighting of homes in the Salt Lake region. The board stopped crowds of passing motorists, often blockading the street.

Animated Billboard Used by League to Sell Wiring

A distinct step forward in endeavoring to promote the "better homes" idea as related to more and better use of electricity in the home has been taken by the Rocky Mountain Electrical Co-operative League in the display of an electrically operated animated billboard. This board has been placed in operation on a much-traveled street in the southeast residential district of Salt Lake City. The board is of the vista or stage type, 10 x 30 ft., using three sets of colored lights, representing daylight, sunset and moonlight, thrown on an attractive setting comprising a high-class residence with appropriate surroundings. As the sunset changes to moonlight the interior of the house appears to become lighted up, all of the windows presenting a striking example of a well-lighted home, from an exterior view.

The lighting effects produced automatically, combined with the attractive setting, are producing excellent results, and the attention of practically every passer-by is drawn to the display. On the first night of operation, 232 cars stopped to watch it, and an average of 75 cars has been stopping each night since that time. Several times the streets have been blockaded as a result.

A very small amount of copy is used, as shown in the picture.

The board was constructed and placed in operation by the American Animated Sign Company, a Utah corporation.

Electragists, Southern Division, report on June Wattage Sold.—Reporting on wattage sold for June, 18 reports turned in to the secretary of the California Electragists, Southern Division, show that a total wattage of 120,614 was represented in appliances sold during that month.

New Mexico Central Station Revamps Sales Room

Entirely rearranging its sales and office facilities about six months ago, when expansion of business necessitated additional room, The Albuquerque Gas & Electric Company, Albuquerque, N. M., has achieved distinction in its territory for its well arranged offices.

The arrangement is the personal idea of Arthur Prager, general manager of the company, and since July 1 president of the Rocky Mountain Division, N.E.L.A.

The color scheme is gray, even in the gray stain used on the oak cabinets and fixtures.

Electrical men attending the New Mexico convention last year agreed that the entire arrangement and especially the lighting was the best to be found in any central station in the Mountain country.

The ceiling units are 300 watts mounted on 12-ft. centers. Mirrored glass window reflectors of 150 watts each on 12-in. centers are employed. The average intensity inside the display room is about 35 foot-candles while in the windows it is about 100 foot-candles.

At the right of the salesroom as it is entered, living-room furniture is employed. The purpose of this is not for appliance demonstration but for comfort and convenience to customers and is used especially as a meeting place.

The information desk is immediately available from the main entrance. It is in the center of the office and includes the company telephone switchboard. Indirect electric signs are utilized for each desk and division.

It is interesting to note that the company just recently started actively to merchandise. Since the photographs were taken an incandescent lamp display has been added. Results have been very satisfactory in a commercial way, according to Mr. Prager.

Central Station Industrial Heating School Completed.—What is said to be the largest and most successful industrial heating school for central-station men ever held was carried on from June 14 to 26, inclusive, in East Pittsburgh, Pa. Representatives of central stations from all over the country studied the advantages of electric heat for industrial processes and the possibilities of the market from a central-station point of view under the leadership of Westinghouse engineers and sales representatives. In addition there were ten Westinghouse students, engineers and sales representatives, and one representative of an industrial concern.

A CENTRAL station that has made a success of merchandising is the Albuquerque Gas & Electric Company, Albuquerque, N. M. This company recently rearranged its entire office to conform with the needs of a growing section for service. Arthur Prager, general manager, conducted the rearrangement personally, and the results are such that he has received commendation from all who have visited the offices. (1) Shows the night illumination of the office and sales building. (2 and 3) Are the windows of the company office, attractively displaying electrical merchandise. The lower picture is a panorama of the store and office. The appliance sales department is to be seen on the left, with the business offices of the company at the center rear. At the right will be noted an attractive living room arrangement.

NEWS OF THE INDUSTRY

Brighton-Merced Tie-Line Important Link in California Interconnection

A great forward step in electric power development in California was celebrated with fitting ceremony Saturday evening, Aug. 14, when the Wilson substation at Merced was dedicated officially. This substation is the southern terminus of the 105-mile, 220-kv., steel-tower tie-line between the Great Western Power Company and the San Joaquin Light & Power Corporation, and the completion of this transmission line not only ties together the power resources of two of the largest operating companies on the Pacific Slope but it strengthens interconnection of systems throughout the length of California and makes possible interchange of substantial blocks of power from the Mexican border to the Oregon line.

Built with the thought of thorough and substantial state interconnection in mind the primary purpose of the line is to conserve water and fuel resources of the two interested companies, which are the Pacific Coast subsidiaries of The North American Company. The Western Power Corporation of New York, which had previously operated the Great Western Power Company of California, purchased in 1924 the control of the San Joaquin Light & Power Corporation. (Journal of Electricity, Dec. 15, 1924, p. 454.)

Subsequently the Western Power Corporation of New York became one of the allied properties of The North American Company, with H. P. Wilson of New York still retaining the presidency. (Journal of Electricity, Sept. 15, 1925, p. 222.) The tie-line and substation which have just been completed were projected by Mr. Wilson, in whose honor the substation was named.

The line starts at Brighton, near Sacramento, in the territory of the Great Western company. Approximately $2,000,000 is represented in its cost with an additional $750,000 invested in the substation. It permits the transmission of electricity generated in the hydroelectric plants a distance of approximately 450 miles, with laterals distributing the current to an average width of 150 miles.

The Great Western Power Company serves the San Francisco Bay district and the cities, towns and farms of the Sacramento and Napa Valleys of northern California. Its auxiliary steam plants are located in the San Francisco Bay region and its hydro plants are in Plumas County where an enormous watershed, feeding the Feather River, runs its waters into Lake Almanor, greatest artificial power reservoir in America, with a capacity of 1,300,000 acre-ft.

The San Joaquin Light & Power Corporation, with its auxiliary, the Midland Counties Public Service Corporation, serves the San Joaquin Valley counties of Mariposa, Merced, Madera, Fresno, Tulare, Kings and Kern, and the Coast counties of Monterey, San Luis Obispo and Santa Barbara. Its hydro plants, twelve in number, are located along the rivers flowing from the Sierra Nevada into the valley, several of them stream-flow plants and others drawing their water from a huge reservoir in Crane Valley, 50 miles from Fresno. The steam plants, maintained for standby service, are located in Kern County, operated by natural gas from the oil fields.

The two companies have a combined connected load of 675,000 kw. and serve 165,000 consumers, but they have different classes of service. The Great Western company's principal service is in the San Francisco Bay district. The San Joaquin company carries a substantial industrial load, chiefly in the packing houses of the fruit-growing sections and in the oil fields, but its service is largely agricultural, with more than 9,000 farms connected to its lines. In consequence the peak loads of the companies come at different times of the year and the peak demands at different times of the day.

The dedicatory ceremonies were conducted in the presence of state, county and municipal officers from virtually every section of California, civic and industrial leaders and several hundred especially invited guests and stockholders of the two companies. It was a joint celebration, with chief features of the entertainment contributed by employees of the Great Western and San Joaquin companies. To Miss Maxine White of Bakersfield was accorded the honor of throwing the switch that set the power plant in motion.

Lester A. Ready, chief engineer of the California Railroad Commission, delivered the principal address of the evening.

"This transmission line becomes an effective connecting link between all of the electric utilities of northern California and those of southern," said Mr. Ready in part. "Its capacity at the present time of approximately 40,000 kw. is without question adequate for the present for all of the probable exchange of power which may be justified. It is suceptible of increase in capacity to serve fully for many years in the future. We can now say, in full truthfulness, that there is a complete interconnection of the power systems throughout the length and breadth of California. . . . What we are celebrating here tonight, and what justifies this dedication ceremony, is the practical accomplishment of the spirit of co-operation, fair treatment and of joint endeavor for mutual benefit, that this transmission line and substation are physical demonstrations of. This spirit of co-operation, of joining of forces for the mutual good, has been one of the secrets of the development of this great state of ours. . . . . We are here dedicating more than anything else a useful manument to the continuing spirit of co-operation."

James B. Black, vice-president and general manager of the Great Western Power Company, and A. Emory Wishon, vice-president and general manager of the San Joaquin Light & Power Cor-

The newly opened Wilson substation of the Great Western Power Company, southern terminus of the tie-line between that company's system and that of the San Joaquin Light & Power Corporation, is of the most modern design and equipment. The three views reproduced show (left) the towers carrying the 220-kv. transmission line with bus structure in background, (center) the building which houses the condenser, and (right) transformer bank and bus structure.

poration, made brief addresses touching upon the significance of the new tie-line. Richard Shaffer, president of the Merced Chamber of Commerce, was master of ceremonies.

The outstanding features of the Wilson substation are the transformers which, according to the engineers of the General Electric Company, builder of all the machinery for the plant, are the largest in physical dimensions ever built, and the building which houses the condenser. Built at this time to accommodate two 25,000-kw. synchronous condensers, it is so planned as to permit of an addition of equal size giving enough space for two more condensers with the necessary control and switching equipment.

Pioneer Washing-Machine Maker Tours Pacific Coast

California ranks with Ohio and Pennsylvania as one of the leading washing-machine states in the Union in the opinion of John Rocke, pioneer washing-machine manufacturer, who is touring the Pacific Coast. Mr. Rocke, who organized The Meadows Manufacturing Company of Bloomington, Ill., twenty-seven years ago, is chairman of the board of directors of that company and chief engineer in charge of factory production.

In discussing the new model just announced by his company Mr. Rocke stated that $15,000,000 worth of new machines had been sold in four weeks. At the present time the factory is producing 3,000 machines a month and expects to double that capacity in sixty days.

Mr. Rocke is keenly interested in conditions as he has found them on the Coast and is taking advantage of every opportunity to study the situation, with particular attention of course to the possibilities for the marketing of washing machines.

Select Site for Dam for Second Unit of Skagit Project

The site for the 350-ft. masonry dam at Diablo Canyon, to be built at an estimated cost of $2,800,000 by the city of Seattle as a second unit in the Skagit River hydroelectric project, has been decided upon, according to a recent statement of J. D. Ross, superintendent of the light department. The determining factor is a bed of hard granite 35 ft. below the surface of the river and extending for more than 400 ft. along its course.

Work will start as soon as materials and equipment can be moved to the site, this depending upon the completion of the railway extension from Gorge Creek, about 4½ miles. The city council utilities committee has recommended that the railway work, which will cost $350,000, proceed at once.

City Must File Answer in Suit Brought by Power Company

A demurrer filed by the city of Los Angeles in the suit recently brought against it by the Southern California Edison Company to recover judgment for a power bill amounting to $840,154.96 which the plaintiff alleged is overdue and which the city has failed to pay has been overruled by Judge Ira Thompson of the superior court. In the original complaint filed June 15, 1926, the Edison company simply alleged the gross amount of indebtedness, and the significance of the action taken by the superior court was that the company will not be obliged to set out in detail the character of its claims. As a result of the ruling the city now will be obliged to file an answer.

Details of the original complaint were published in the Journal of Electricity, July 1, p. 31.

Hoover Pleads for Broad National Program in Development of Water Resources

Speaking before the Columbia River Basin League in Seattle Aug. 21, Herbert Hoover, Secretary of Commerce, made a plea for "definite co-ordinated plans and organization for the development of our water resources." He declared the country had "wasted vast sums of public money under political pressure" and that the time had come to submerge local considerations and center on major engineering jobs that would fulfill a "great national design." Prior to his speech Secretary Hoover had made a survey of the proposed Columbia River Basin irrigation project. Of the development of the Columbia River Basin he said:

> The Columbia River Basin should be embraced in a national program of major water improvement. In the upper stretches of this river there are two and one-half million horsepower and there is a possibility of adding 1,750,000 acres of land to intensive cultivation. This project involves interstate questions affecting the interest of four states. It involves the creation of large storage, the regulation of the flow of the river, and the proper and systematic location of dams for reservoirs and power. And there is here again conflict over all of these matters. Above all, in this situation, too, a co-ordinated program, definitely determined, that can be hewn to over a term of years, is the need of this moment.

Touching upon the Colorado River, Mr. Hoover said that "a great dam at Boulder Canyon and subsidiary works is clearly an urgent and immediate necessity." He continued:

> It is one of the major water developments before us. I believe that in this case the entire outlay can be recovered from the sale of power and water. Many other great steps will need to follow because there must be a score of great dams before the whole of the Colorado Basin is developed and they may well require a whole generation for their completion. But above all, there must be a full co-ordination of development, so that any part undertaken whether by the government, by power companies, by the states, or by the municipalities, or the irrigation districts, shall be part of a complete scheme whose full realization will result in the maximum utilization of the river.

When electrical power is involved in the development of water resources the problems become more complex, the secretary declared. He went on to say:

> It is my own view that the federal government should not go into the business of either generating or distributing electrical power. There may be some special cases, but our general policy should be against it. Where power is a by-product of dams for other major public purposes such as navigations, etc., then the federal government should lease the power rights so as to recover as much or the whole of its total investment as can be. Where the development is for power only then it should be leased under provisions of the Federal Water Power Acts which amply provide for control by the government. Where such major electrical development may in minor part affect the other purposes of irrigation or domestic water storage, etc., then the rights of these users can be protected by conditions in the leases and those acts.

Price Reduction Announced on All Frigidaire Lines

Made possible through quantity production and increases in output planned for 1927, price cuts ranging from $20 to $90 were announced Aug. 10 by the Frigidaire Division of the Delco Light Company, Dayton, Ohio. The price cut affects Frigidaire metal cabinet models, residential and commercial installations and also cooling units designed for use in the standard makes of ice boxes.

The company maintains a permanent engineering and research department of 150 men, and this department, through simplification of designs and methods is credited by E. G. Biechler, president and general manager, for part of the savings in production which are reflected in the price reduction.

At the time of the price reduction the company had sold more than 200,000 electric refrigerator units. The factory schedule calls for an output of 600,000 refrigeration units next year.

Satisfactory progress is being made in the expansion program for the $20,000,000 Frigidaire factory, whose increased facilities are to be available for production early in 1927. Contracts have been let and work started on additional buildings which are being constructed under private contract, supervised by construction engineers of the General Motors Corporation. The new buildings will be completed early in October, which will give plenty of time for installation of machinery by the end of the year.

Utility First-Aid Methods Save Two Girls from Drowning

First-aid methods as taught in the safety department of the Pacific Gas and Electric Company recently resulted in saving two girls from death by drowning. Both young women, members of a party swimming in the Feather River at Bidwell Bar, Calif., were rescued and brought ashore unconscious.

Ivan Wright, member of one of the first-aid teams of the company's Colgate Division, took charge of the situation. Directing another young man, Herman Cochrane, how to work on one of the girls to restore respiration, Mr. Wright worked over the other. After six minutes one was restored to consciousness and in ten minutes the other was breathing again.

In reporting the incident the Marysville Democrat concluded with this significant paragraph: "In the Bidwell Bar emergency Wright was the only one in the whole party who knew what to do to restore life to a person under such circumstances, and without his presence the two girls would have been given up as dead."

Industrial Consumption of Electricity.—Although only 54 per cent electrified, the iron and steel industry leads in the consumption of electrical energy. Textiles come next; their electrification is 56 per cent. The other industries follow in the order in which they consume electrical power, together with their percentages of electrification: food, 60 per cent; lumber, 31 per cent; paper, 57 per cent; chemicals, 60 per cent; stone, glass and clay, 59 per cent; transportation, 87 per cent.

Longest Multiple-Arch Dam in the World Is Completed by Edison Company

Completion of the Florence Lake dam across the south fork of the San Joaquin River by the Southern California Edison Company was announced Aug. 14. This dam, which crosses the river just down stream from the northern portal of the Florence Lake tunnel which was completed in February, 1925, has a crest measurement three-fifths of a mile in length and is the longest multiple-arch dam in existence. Its construction will create a lake which will rival Huntington Lake in size and beauty, having a circumference of nine miles as compared with fourteen miles of shore line around Huntington Lake.

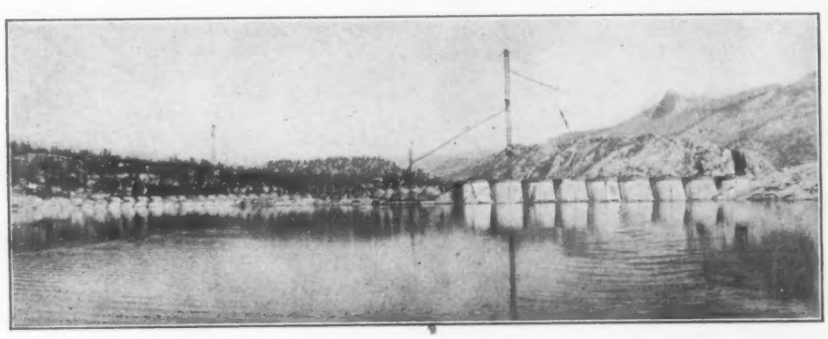
The excavation for the Florence dam was commenced in the fall of 1924. The first concrete was poured in March, 1925, and pouring continued during the summers of 1925 and 1926 up to the completion of the work. Concrete cannot be mixed and poured during the winter months in the high altitudes so that the actual building was confined to the summer seasons. The dam has a maximum height above the channel of the river of 147 ft. Rock and sand used in the mixing of the concrete were salvaged from the hard gray granite excavated from the Florence Lake tunnel and hauled out to the dump while the tunnel was being constructed.

View of section of dam from downstream side showing some of the arch ring forms still in place.

Fifty-eight arches were required for the structure, supported by buttresses on 50-ft. centers. The thickness of the arch ring varies from 4.35 ft. at the foot to 1.5 ft at the crest. The face of the dam has a slope of 42 deg. with the vertical.

In selecting the location to erect the dam the company took advantage of the existence of a natural ridge of rock more than one-quarter of a mile in length standing approximately in the center of the dam site, and have extended the dam structure out from the sides of the valley to meet the two opposite ends of this ridge. The rock thus forms a part of the dam itself, and enabled the company to effect considerable economies in damming the stream.

In preparing the 950 acres which comprise the floor of the reservoir it was necessary to cut a large number of trees. A saw mill was erected on the ground and the trees were converted into lumber which was used in the construction of the forms for the dam.



General view of Florence Lake dam just completed by the Southern California Edison Company as a part of its hydroelectric project on the Big Creek and San Joaquin Rivers in the high Sierra in the northeastern part of Fresno County, Calif.

Spokane Lumber Company Plans Power Development

Applications for the appropriation of approximately 200 sec.-ft. of water from Little Spokane River and nearby creeks for the development of electric energy have been filed by the Spokane Lumber Company with the state supervisor of hydraulics, Olympia, Wash. Permission also was sought for the formation of two reservoirs to store 9,780 and 1,850 acre-ft. of water, respectively.

The power, quantity of which has not yet been determined, will be used in mining and also offered for sale to other utilities, while most of the water diverted would be used for irrigation in the vicinity, it was stated. Cost of the project is estimated at $210,000.

The Spokane Lumber Company now owns and operates dams at the outlet of Horseshoe Lake and Blake Lake which offer storage from the spring floods. It was pointed out in the application that now it is desired to release the water in uniform quantities so that the flow in the several streams to be used would be more or less uniform during the entire year.

Two Applications for Licenses for Alaska Power Projects.—The Home Power Company of Skagway, Alaska, has applied to the Federal Power Commission for license covering a proposed project in the Tongass National forest. The Sunny Point Packing Company of Seattle has applied for a license for a small power development near its cannery on Gunnock Creek, Kupreauoff Island, Alaska.

New California Company Formed to Sell Washing Machines

Recently organized for the specific purpose of selling one line of washing machines, The Domestic Appliance Company, Inc., has opened executive headquarters at 1535 San Pablo Boulevard, Oakland, Calif. This company will concentrate its efforts in distributing the Model H machine of the Meadows Manufacturing Company, Bloomington, Ill., although it will handle the entire Meadows line in California.

A complete merchandising plan has been worked out in conjunction with a comprehensive advertising campaign. In forming its plans the company has recognized the fact that the average margin allowed the dealer is not sufficient to allow him to market the machine actively and also make a profit and has arranged to take a smaller margin itself in order to give the dealer a larger one.

Nine retail stores have been established by the Domestic Appliance Company in Alameda and Contra Costa Counties in California. In addition to establishing retail outlets with electrical, specialty, hardware and department stores, a similar number of retail stores will be organized in the vicinity of Los Angeles in the next sixty days.

Officials of the new company are: C. B. Angenete, president and general manager; R. D. Brigham, vice-president, Anglo-California Trust Company, San Francisco, vice-president; Leon Sloss, assistant trust officer, Anglo-California Trust Company, secretary-treasurer.

Two More Units Recommended for Don Pedro Power Plant

A recommendation that two additional power units be installed in the Don Pedro power plant of the Turlock and Modesto Irrigation Districts has been made by R. V. Meikle and W. H. Holmes, chief engineers of the respective districts, and R. W. Shoemaker and R. J. O'Connell, electrical engineers for the same districts. The cost is placed around $750,000. The report, which the engineers were authorized to prepare at a joint meeting of the directors on June 18, 1926, was placed before the Turlock directors at a late hour Aug. 9.

The addition of these two units will double the capacity of the Don Pedro power plant and will enable all of the water now used for irrigation to be used also for generating power. Under the present condition it is necessary during the irrigation period to open the irrigation outlets in the dam to deliver water, in addition to that passing through the wheels. The sale of the additional power thus developed will be delivered to the San Joaquin Light & Power Corporation.

As the Don Pedro power plant has been operating for the past three years at a yearly load factor of approximately 80 per cent, the additional capacity will enable the necessary repairs to be made with less interference with plant operation.

At the time the Don Pedro power plant was built in 1922-1923 openings were provided in the dam for two additional units and provision also was made in the tail-race tunnel for their installation.

Engineering Societies Employment Service in San Francisco

As a result of the successful operation of the San Francisco office of the Engineering Societies Employment Service for the past eight months, the work will be continued as a time-saving aid to employers looking for men to fill positions requiring technical training and experience and also as an aid to men seeking employment along engineering and chemical lines. The extent of the service is shown by the fact that more than 200 positions, ranging from draftsman to resident engineer on hydroelectric construction, have been filled by men who have gone to nearly every Western state as well as Mexico and Alaska.

Men are registered from all over the world, and a weekly bulletin of positions open serves to inform the members regarding employment requirements which cannot be filled from the classified files in the office. There is no charge to the employer for this service and correspondence is invited from anyone having a vacancy in his organization.

No discrimination is shown against non-members of any of the supporting societies, though non-members securing employment through the bureau are required to pay 10 per cent of their first month's salaries to a licensed agency specified by the bureau, as the bureau itself is not licensed.

Good Progress Is Being Made on Chelan Development

With June, 1927, now as the objective for completion of the first unit of the Chelan development of the Chelan Electric Company, the contractors now have more than 600 men at work on the project being built for the subsidiary of The Washington Water Power Company. The first unit will have a capacity of 32,000 hp.

The first of the two tunnels which will be required for the final installation of 128,000 hp. lies south of the Chelan River Entering the tunnel from two adits and two shafts, workmen already have dug more than 3,500 ft. of the 12,000-ft. tunnel. Much of this is in a granite formation and requires no timbering. When completed the tunnel will be lined with concrete leaving a 14-ft. diameter. Most of the head of 380 ft. is between the surge tank and the power station. Excavation work is now well under way on those two portions of the project where dragline with a 100-ft. loom is used with a 4-yd. bucket. Three shifts a day are being used by the contractors in the tunnel.

Excavation work is expected to begin in September on the dam, to be located on the Chelan River near where it flows out of Lake Chelan. The crews will be busy all winter on the project, and camp buildings have been constructed of materials and equipment suitable for cold weather.

Work Under Way on B. C. Electric Company's Alouette Plant

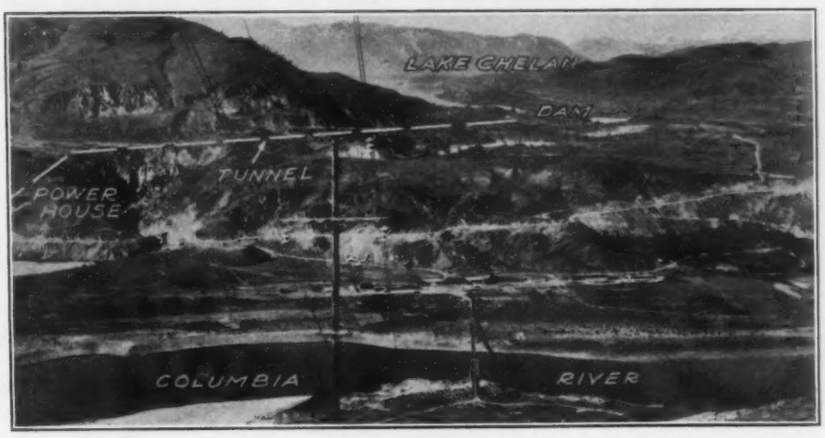
Work has been started on the construction of the Alouette power plant of the British Columbia Electric Railway, the contract having been let to the Northern Construction Company and J. W. Stewart, Ltd. The contract covers the excavation for the power house and yards, construction of the complete power-house building, and driving of the penstock tunnel. The excavation extends 40 ft. below the high-water level of Stave Lake, which necessitates carrying on the work below water level behind a cofferdam. This cofferdam is already in place, having been constructed during the low-water period last spring by the company's construction department.

As soon as the building is completed to the crane rail the power-house crane will be installed and the erection of the turbine and generator started. This plant, which will add 12,500 hp. to the generating capacity of the company's system, is expected to be ready for operation by the fall of 1927.

Electric Mill on Comstock Lode 1,700 ft. Underground

An electrically operated 200-ton mill soon will be functioning 1,700 ft. below the surface of the Consolidated Virginia mine in Virginia City, Nev., on the famous Comstock Lode. Space now is being hollowed out of solid rock for the mill site.

After the ore, obtained by top-slicing the old bonanza workings, is dropped down to the mill and crushed, the tailings will be sluiced out through the 4-mile Sutro tunnel, which connects with the mine near the mill site, and only the concentrates will be sent up the shaft. The result will be an immense saving in the handling of the ore.



The site of the Chelan power project being developed by the Chelan Electric Company, a subsidiary of The Washington Water Power Company, Spokane, showing locations of power house, tunnel and dam.

Voltage-Raising Plans to Effect 110-kv. Interconnection

Raising the voltage of a 60-kv. transmission line from Coulee to Chelan, Wash., to 110 kv. on Aug. 8, and rapidly completing arrangements for raising voltages extensively on other transmission lines, The Washington Water Power Company is engaged in an important program of line improvements for early fall.

Increased irrigation loads in the Okanogan and Chelan districts made necessary the extension of 110 kv. to Chelan where a new power station now is being built.

Line crews have been busy all summer building a new transmission line from Latah Junction to the Coeur d'Alene mining district, a distance of 67 miles. All but four miles of this line now is being operated at 60 kv. and the entire line will be ready soon. The line will be raised to 110 kv. soon, after a new substation is constructed at Latah Junction. At that time the new line from the Long Lake power station to Spokane and south to Latah Junction will be raised to 110 kv. This will give that voltage from the Long Lake station, through Spokane to Mullan Junction in the Idaho panhandle,a distance of 126 miles. A tie-line from there connects with the Montana Power Company's substation a few miles further on. The Montana company has restrung two 110-kv. lines from its Thompson Falls plant to the interconnection with The Washington Water Power Company system, putting in new copper, to be ready in September.

This arrangement will make possible interconnection at 110 kv. between the Montana Power Company's system and The Washington Water Power Company, including its line from Long Lake to Taunton, and the Chicago, Milwaukee & St. Paul Railway's transmission line to Puget Sound.

The Washington Water Power Company is making extensive installation of new substation equipment for the higher voltage in the Coeur d'Alene mining district at this time.

Battery Company Adopts Group Insurance Plan.—An extenseive program of group insurance affecting about 4,500 employees in more than twenty cities throughout the United States and Canada has been adopted by the Electric Storage Battery Company, Philadelphia. Included in the plan are life insurance, health and non-occupational accident coverage and accidental death and dismemberment protection. The life insurance alone will reach a total of approximately $5,000,000, while the accidental death and dismemberment insurance will amount to more than $1,200,000.

New Power Plant at Grand Lake, Colo., Improves Lighting System.—Grand Lake, Colo., where annually the Lipton Cup yacht races are held approximately one and a half miles above sea level, now has a greatly improved lighting system following completion of a $25,000 hydroelectric plant. The plant, erected by the Grand Lake Lodge, replaces a small unit which has outgrown its usefulness. It is located on a mountain side about a mile from the hotel where there is a fall of 200 ft. of water used for generating purposes.

Work Started on New Substation for Edison Company

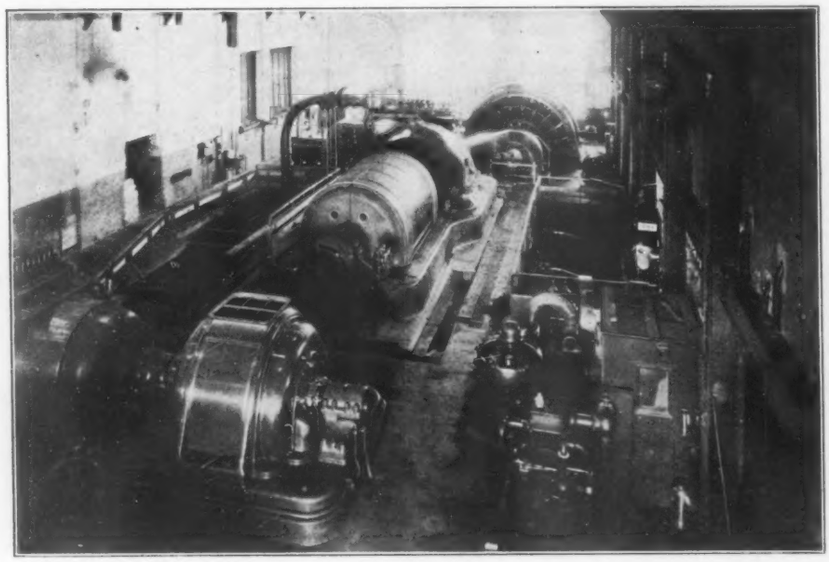
Work was begun July 27 on the construction of a new outdoor substation for the Southern California Edison Company, at the corner of Bonnie Beach Place and Whiteside Avenue, Long Beach, Calif., according to Myron McNeal, local district manager. This new station is the standard outdoor type of substation used by the company as the initial unit on new substation sites.

When the load for the community has built up to such an extent as to require more substation capacity, this equipment will be dismantled and moved to another location, and a larger type of station built in its place. The territory to be served by this station is a rapidly growing section according to officials of the company, and the new substation with a capacity of 20,000 hp. is to be situated in the center of this district. The estimated cost of this installation is $18,085.

Portland Company Brings in New 20,000-kw. Steam Unit

Starting up the new 20,000-kw. Curtis steam turbo-generator at Station "L" early in August, the Portland Electric Power Company, Portland, has brought its total generating capacity up to 181,272 hp., and now operates the largest hog-fuel steam plant in the Northwest. The unit (Journal of Electricity, Feb. 15, 1926, p. 159) is a General Electric Company type ATB-4, 23,000-kva., 1,800-r.p.m., 11,000-volt machine, and is designed to operate at a throttle pressure of 175 lb. per sq.in. with a temperature of 550 deg. F. At present it will operate at low pressure on surplus steam from the present boilers, but plans for expansion of Station "L" next year contemplate the installation of increased boiler capacity and a change in throttle pressure to 385 lb. This change will increase the efficiency of the unit, reducing the steam consumption from 11.85 lb. per kw-hr. to 9.8 lb. per kw-hr. at the most efficient point of operation.

The unit was started by O. B. Coldwell, vice-president and general manager of the company, in the presence of a few company officials, city officials and business men of Portland. Interesting to the laymen present was the fact that the unit occupied a space 42 ft. long, 22 ft. wide and 13 ft. high and yet was smaller than a nearby old Corliss engine possessing one-tenth the capacity and using two and one-half times more steam per kw-hr. generated.



New 20,000-kw. turbo-generator unit installed at the Portland Electric Power Company's Station "L." Through the installation of this unit the company now operates the largest hog-fuel steam plant in the Northwest.

News Briefs

Contract Let for Power House at School.—The State Board of Control at Olympia, Wash., has awarded a contract to Steiro & Hansen of Tacoma, Wash., for erection of a power house at the State Training School for Girls at Grand Mound, Wash., on a bid of $11,716.

B. C. Electric Company Opens New Substation.—The British Columbia Electric Railway Company, Vancouver, has put its new substation, at Fifth Avenue and Fir Street, Vancouver, into operation. It is equipped with a 1,000-kw. motor-generator. This substation will be made automatic in the near future.

Company Reports Increase in Customer-Owners.—An increase from 377 owners of preferred stock in March, 1925, to 1,009 owners in March, 1926, is reported by the Coast Valleys Gas & Electric Company. In the same period the number of shares of preferred stock outstanding increased from 7,530 to 14,730.

Work Started on Second Unit for Valmont Plant.—Installation of a 25,000-kw. unit in its Valmont steam plant was started by the Public Service Company of Colorado late in July. The completion of this second unit will increase the rating of the plant to 45,000 kw.

Power Line Franchise Granted in Snohomish County, Wash.—The firm of Donaldson Brothers, Everett, Wash., has been granted a franchise by the county commissioners of Snohomish County to erect and construct power lines in Darrington and vicinity for the purpose of furnishing electricty for power and telephones.

Manteca-Salinas Transmission Line Completed.—The 104-kv. wood-pole transmission line from Salinas, Calif., to Manteca, Calif., built by the Pacific Gas and Electric Company, has been completed and is now in operation. A new transformer has been installed at the Salinas substation to step down the voltage from 104 to 60 kv. for distribution in the Salinas territory.

Additional Equipment Being Installed in Edison Substation.—Work has begun on the installation of additional electrical equipment in the Lancaster substation of the Southern California Edison Company. A new 60-kv. switching rack, together with necessary oil switches, meters and relays will be installed. The approximate cost of this new installation has been set at $42,153.

Portland Man Files on Deschutes River, Ore.—Among recent applications for water filed in the office of the state engineer, Salem, Ore., is one for appropriation of water from the Deschutes River for power development to cost $3,000,000. The meager information given out does not disclose the amount of water desired, the place at which it is to be appropriated, nor the size of the proposed development.

Vernon, B. C., Gives Guarantee Not to Contract for Electric Supply for Three months.—The city of Vernon, B. C., has given the Royal Securities Corporation of Montreal a guarantee that it will not enter into a contract for the supply of electric energy, nor dispose of its water rights at Shuswap Falls for a period of three months, while the corporation's engineers are investigating the possibilities of developing and marketing power.

Recommendations on the Denver-Cheyenne Air-Mail Markers Forwarded to Washington.—Recommendations covering the installation of markers for the contract air mail route between Denver, Colo., and Cheyenne, Wyo., and for efficient illumination at the Denver terminus have been forwarded to the Department of Commerce at Washington by W. Irving Glover, second assistant postmaster general of the United States. Mr. Glover, who is of the opinion that adequate illumination is essential to efficient air-mail service, recently spent some time investigating conditions along the Pueblo to Cheyenne route.

Colorado Utility Starts Construction on New $300,000 Power Unit.—The Trinidad (Colo.) Electric Transmission, Railway & Gas Company has started construction on a $300,000-power-unit addition to its plant at Walsenburg, Colo. A new power line between Big Four and Rouse is likewise part of an expansion program necessitated because of demands made upon the plant by neighboring mines during the busy season last winter, according to H. T. Dabney, manager of the company at Walsenburg. It is believed that the new machinery, a 6,000-kw. turbine constructed by the General Electric Company, will be put into operation early next fall.

Northwest Electric Light & Power Association

Executive Committee Discusses Many Important Subjects

A wide number of subjects was discussed at the meeting of the executive committee of the Northwest Electric Light and Power Association held in Portland Aug. 9. Among the more important was that of the work of the Public Relations Section. D. C. Green, executive committee chairman, suggested that group meetings of company employees be held for the purpose of educating them with reference to the company's business so that in their daily contact with their neighbors and the public they would have sufficient information to be able to answer intelligently questions asked them regarding the company and its business. Mr. Green gave it as his opinion that this method would be much more effective than public-speaking campaigns.

The abolition of the industrial relations committee, the customer-ownership committee and the committee on co-operation with educational institutions was decided upon. The National Electric Light Association has a customer-ownership committee and it was felt that any information it might desire might be secured readily from the various companies. The vice-presidents of the various states should handle the work in regard to co-operation with educational institutions, in the opinion of those present.

In discussing the activities of the Commercial Section it was suggested that that section act as a clearing house for new ideas which could be passed along to member companies, thus using the section as a sales builder. The importance of gathering data on water-heater metering also was emphasized, as well as the gathering of information on the cost of servicing electric refrigerators.

That an investigation should be made by the Commercial Section into the practices of the various companies with reference to service furnished customers in connection with electric ranges and similar appliances was the consensus of opinion. It also was decided that the section should secure some information in regard to competitive power.

In discussing the activities of the Technical Section it was suggested that that section keep member companies fully advised of changes in the art.

Matters recommended for the attention of the Accounting Section included an investigation into the matter of handling payments on washing machines and other merchandise and that of shortening accounting procedure and eliminating unnecessary reports.

Lewis A. Lewis, sales manager, The Washington Water Power Company; Norwood W. Brockett, director of public relations, Puget Sound Power & Light Company, and A. C. McMicken, sales manager, Portland Electric Power Company, Portland, were appointed a committee on the amending of the constitution. C. W. Lundquist, secretary of the association, was named chairman of the membership committee.

A motion that the next convention be held in Salt Lake City was carried. It was suggested that it be held either the week before or the week after the P.C.E.A. convention so that N.E.L.A. officers might attend.

Lighting Schools Planned in This Year's Activities

Resulting from a conference between D. C. Green, vice-president and general manager, Utah Power & Light Company, Salt Lake City, president of the Northwest Electric Light and Power Association, and Clark Baker, of the National Lamp Works of the General Electric Company, Oakland, and chairman of the lighting committee of the Pacific Coast Electrical Association, tentative plans have been outlined whereby several lighting schools will be established in the territory of the Northwest Association during the forthcoming year.

Three schools are to be conducted, one each in Portland, Seattle and Spokane beginning some time in February, according to present plans. The schools are to be practically the same in every respect as the school to be conducted in San Francisco in September under the auspices of the San Francisco Bay Cities chapter of the Illuminating Engineering Society, under direction of Mr. Baker, president of that body.

According to the arrangements made between Mr. Green and Mr. Baker, the latter will attend the midwinter conference of the Commercial Section of the Northwest Electric Light and Power Association to be held some time in January. He will outline his plans for the lighting schools and efforts will be made to launch the schools immediately. Representatives from Boise, Idaho, and Salt Lake City will attend these schools and after completing the course will be given special training by Mr. Baker to fit them to organize and conduct similar schools in their own territory.

The association intends to purchase a complete set of the equipment needed for the schools so that more courses may be given if occasion should demand them. Under the concentrated plan worked out by Mr. Baker the school can be conducted in five sessions, usually arranged as two afternoons and three evenings in one week.

Announces Subcommittee Chairmen of Engineering Section

Appointments of chairmen of the subcommittees of the Engineering Section, Northwest Electric Light and Power Association for the current year have been announced by F. J. Rankin, chief engineer, Idaho Power Company, Boise, the section chairman, as follows:

Accident prevention—J. B. Fisken, consulting engineer, The Washington Water Power Company, Spokane; electrical apparatus—D. W. Proebstel, superintendent of tests, Portland Electric Power Company, Portland; hydraulic power—O. L. LeFever, superintendent, Northwestern Electric Company, Portland; inductive co-ordination—G. E. Quinan, chief electrical engineer, Puget Sound Power & Light Company, Seattle; meters—R. E. Thatcher, superintendent of service, Central District, Puget Sound Power & Light Company, Seattle; prime movers—C. C. Simeral, assistant chief steam engineer, Portland Electric Power Company, Portland; overhead systems—T. A. Purton, engineer, Idaho Power Company, Boise; underground systems—E. F. Pearson, electrical engineer, Northwestern Electric Company, Portland.

P.C.E.A. News

Advertising-Publicity Section Meeting Set for Sept. 10

A bulletin sent out to the members of the Advertising-Publicity Section, P.C.E.A., by Richard E. Smith, chairman, notifying them of a section meeting at 10 a.m. in the French Room of the Palace Hotel, San Francisco, outlines a new plan for midyear sectoin meetings.

To quote from the bulletin itself: "The morning session is to be devoted to business and plans of the section. The afternoon session will be a junior convention, with a study topic, papers, discussions, and all the trimmings. Attendance at this afternoon session is not to be limited to members of the section, as everyone in the industry who is interested in the subject to be discussed, 'The Use of Direct-Mail Advertising to the Industry,' is invited, nay is urged to attend."

J. Charles Jordan, of the Pacific Gas and Electric Company, San Francisco, is to be the leader for the afternoon session. E. J. Blum, of Blum's Advertising Agency, and a recognized specialist in the field of direct-mail advertising, will present a paper, after which the meeting will be thrown open for general discussion.

Insurance Committee Has Same Personnel as Last Year

The Insurance Committee, P.C.E.A., will be composed of the same members as served on that committee last year, there having been no change in the personnel.

The committee consists of Herbert Dewes, Southern Sierras Power Company, chairman; Clifton Peters, Southern California Edison Company, vice-chairman; V. D. Armstrong, Truckee River Power Company; R. J. Cantrell, Pacific Gas and Electric Company; W. E. Durfey, San Joaquin Light & Power Corporation; A. C. Johnson, Arizona Power Company; T. P. McCrea, Los Angeles Gas & Electric Corporation; H. R. Peckham, San Diego Consolidated Gas and Electric Company; and L. A. Reynolds, Great Western Power Company.

News of the Electragists

National President to Address California Electragists at Del Monte Meeting

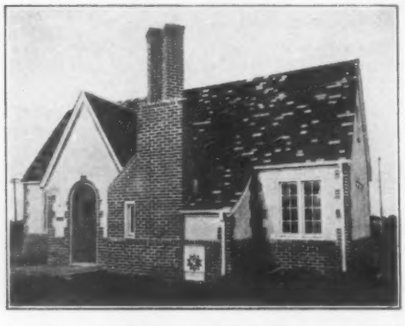
Joseph A. Fowler, president of the Association of Electragists, International, has accepted the invitation of the California Electragists and will be one of the feature speakers at the convention to be held at Del Monte Oct. 1-2-3. Word received by the executive committee of the California Electragists from President Fowler indicates that he will attend the convention and will address the meeting on Saturday afternoon, Oct. 2. He has also been booked to speak before the San Francisco Electrical Development League on Monday following the Del Monte convention.

News that President Fowler would attend the convention gave added importance to the forthcoming convention of California Electragists. It is planned by both the Northern and the Southern Divisions that the occasion shall be made a worthy testimony of the close co-operation between the California Electragists and the central association by getting out a record turnout for the convention.

Registration and hotel arrangements under the chairmanship of H. C. Reid are progressing in good shape, with requests for reservations coming in every day. Indications from this source point to a good attendance.

Publicity and transportation under C. J. Geisbush and E. E. Browne, are being cared for effectively. Vic Lemoge as chairman of the entertainment committee needs no comment. He can be expected to provide all that there is in the cards for the occasion. For golf, Art Dahl has been placed in charge and he too promises everything to a queen's taste.

In charge of ladies' reception will be Mrs. H. H. Walker and Mrs. C. F. Butte, and it is their plan to see that the wives attending the convention shall be given every opportunity for an enjoyable and interesting time.



Denver's fourth electrical home is the first Red Seal home in that territory.

Denver's Fourth Electric Home Is City's First Red Seal

Marking what he characterized as the beginning of a "new era in house construction and home comfort and convenience," Mayor B. F. Stapleton of Denver recently awarded a Red Seal certificate to Walter H. Simon, Denver architect, emblematic of electrical wiring adequacy and safety. The award was made during the weekly meeting of the advisory board of the Electrical League of Colorado, with A. C. Cornell, chairman, presiding. Fire Chief John F. Healy, Raymond Reeves, first vice-president, Denver Real Estate Exchange; Donald Weese, director, Architects' Small House Service Bureau, and others were present to witness the award.

Mr. Simon is the first home owner in Denver to receive the Red Seal certificate in recognition of adherence to wiring standards set by the Society for Electrical Development, New York.

Featured as the first Red Seal electric home to be publicly displayed in the territory, Denver's fourth electrical home was visited by 5,317 adults during an exhibition which lasted eight days.

The demonstration was a part of the program of the Electrical League of Colorado and provided an excellent opportunity for the public to grasp the significance of the Red Seal plan of electrical installation for residences. Twenty-five hundred Red Seal plan consumer booklets, obtained from the Society for Electrical Development, were discriminately passed out to visitors and particular reference was made to the fact that the home had been wired in strict conformance with Red Seal specifications.

The electrical home was a modest bungalow with 6 rooms and full basement containing a den, maid's room, bath, laundry and furnace room. The entire cost of the wiring and fixtures was stood by the builder but the fixtures were selected by him according to the suggestion of the league. Throughout the home no bare lamps were visible, even the frosted or tinted lamps being equipped with suitable glass shades or parchment shields.

Formal award of the first Red Seal certificate in Denver. Mayor Stapleton (left) presenting the certificate to Walter H. Simon, architect, owner of the first Red Seal home. A. C. Cornell, chairman of the league, is standing, center.

J. J. Hutchins of the Valley Electric Company, San Luis Obispo.

In all, 41 electrical appliances were used in the display and these were drawn by lot from the supplies of jobber members of the league. The furniture was loaned for the occasion by one of the local stores specializing in house furnishings.

The wiring installation, exclusive of the garage, consisted of the following 80 outlets: 14 bracket; 17 ceiling; 23 switch (including 6 sets of 3-ways); 22 duplex convenience and 4 special outlets consisting of 1 phone, 1 radio, 1 refrigerator, and 1 oil burner outlet.

C. F. McDonald, electrical contractor for the home, stated that merely his suggestion of the Red Seal plan to Mr. Simon was enough to secure the owner's immediate approval. Incidentally Mr. McDonald has chalked up more Red Seal jobs than any other individual member of the league.

C. T. Smallcomb, Electragist of Los Angeles, on account of increased business has found it necessary to move into larger quarters. He has now moved from 655 Wall Street to new and enlarged quarters at 507 East Seventh Street. This is the fourth move for this company in six years, each move caused by expanding business. "Our ideas for conducting an electrical contracting business were primarily obtained from the Association of Electragists, International, code of business ethics," writes R. E. Condit, of the company, in telling of the move. "We have been members of this association approximately six years and were one of its first members in Los Angeles."

Meetings

Radio Trade Meeting at League Ushers in Exposition

Introducing the Pacific Radio Exposition to the electrical industry, representatives of the Pacific Radio Trade Association presented the program at at the Aug. 23 meeting of the San Francisco Electrical Development League. A crowd filling the ballroom of the Palace Hotel attended the meeting.

A review of what radio has accomplished in the fields of communication and mechanics was given in a comprehensive talk presented by Ellery Stone, president of the Federal Telegraph Company, under the title of "What Radio Means Today." In his talk Mr. Stone spoke of the contributions made by radio engineering to electrical arts. He also summarized the progress of radio in communication and broadcasting of entertainment and information, and predicted a limitation of broadcast stations to one central station in each large center, from which by relay of programs from other similar studios the best talent would be available. The importance of radio to the power companies he showed by citing the increased use of electricity in longer evening hours, battery charging, and more recently the operation of sets directly from lighting circuits.

Arthur Halloran, editor of Radio, and president of the Pacific Radio Trade Association, was chairman of the day.

Co-operation Subject of Talk at Santa Clara League Meeting.—At a recent meeting of the Santa Clara Electrical Development League held in San Jose, Calif., Clyde Chamblin, president, California Electrical Construction Company, and prominent in Electragist affairs, was the principal speaker. Mr. Chamblin discussed the question of how the league could co-operate with other branches of the industry.

B. C. Electric Office Staffs and Families Hold Picnics.—The office staff and families of the British Columbia Electric Railway Company, Ltd., Vancouver, to the number of nearly 600, recently held their annual picnic at Seaside Park where sports and dancing were enjoyed by all. George Kidd, president, and W. G. Murrin, vice-president, were in attendance, and Mrs. Kidd gave the prizes to the successful competitors. The Victoria staff held a similar affair at Elk Lake shortly before the Vancouver picnic.

Utility Employees Hold Picnic.—Employees of the Drum and Sacramento Divisions of the Pacific Gas and Electric Company and their guests enjoyed a highly successful picnic in Grass Valley, Calif., Aug. 21. There were all kinds of races and contests, dinner and "all the fixin's," dancing and other entertainment. One of the main events was a baseball game between the teams from the two divisions. The game was won by the Sacramento Division team. There was an attendance of about 400 at the gathering.

Inaugural Ceremonies of Officers of Los Angeles G. and E. Employees' Association.—The newly elected officers and directors of the Los Angeles Gas and Electric Employees' Association recently were installed with appropriate ceremonies. Following a reception, with the officers and directors and their wives in the receiving line, short talks were delivered by D. F. McGarry, a vice-president of the Los Angeles Chamber of Commerce, Wm. A. Baurhyte, president of the company, and H. B. Wells, president-elect of the association. A concert and dancing concluded the evening. Frank Weiss, temporary chairman of the association, had charge of the affair.

Jobbers and Manufacturers' Representatives Hear Details of Red Seal Plan.—For the purpose of thoroughly acquainting the jobbers and manufacturers' representatives in his territory with the details of the Red Seal plan, G. H. P. Dellman of the San Diego Consolidated Gas & Electric Company recently called a meeting of the members of that branch of the industry. Twenty-five attended the gathering, which was addressed by W. F. Brainerd of the California Electrical Bureau.

COMING EVENTS

Engineering Section, P.C.E.A.—
First Group Meetings Los Angeles, Calif.
Los Angeles Gas & Electric Corporation Bldg.
Sept. 1-3, 1926.

Electrical Supply Jobbers Association, Pacific Division—
Annual Convention
Empress Hotel, Victoria, B. C.
Sept. 7-9, 1926

American Institute Electrical Engineers—
Pacific Coast Convention, Salt Lake City, Utah
Sept. 7-10, 1926

Advertising-Publicity Section, P.C.E.A.—
Palace Hotel (French Room)—
San Francisco,
Sept. 10, 1926

Rocky Mountain Division, N.E.L.A.—
and
Colorado Public Service Association—
Joint Convention, Glenwood Springs, Colo.,
Sept. 13-16, 1926

California Electragists—
Annual State-wide Meeting—Hotel Del Monte
Del Monte, Calif.
Oct. 1-3, 1926

Northwest Association of Electrical Inspectors—
Annual Convention—Multnomah Hotel,
Portland, Ore.,
Jan. 18-19, 1927

Reservations for Jobbers' Convention Should be Made Promptly.—A second notice has been sent out by Albert H. Elliot, secretary, Pacific Division, Electrical Supply Jobbers Association, requesting that reservations for that division's convention be made promptly. The convention is to be held at the Empress Hotel, Victoria, B. C., Sept. 7-9, and as the northern committee must make full arrangements, Mr. Elliott stresses the fact that all data relative to reservations must be in his hands without delay.

Book Reviews

ALTERNATING CURRENTS

By Carl Edward Magnusson, professor of electrical engineering, University of Washington, Seattle. Third edition, 1926. 611 pages, 522 illustrations, 6 x 9 in., cloth bound. McGraw-Hill Book Company, Inc., New York. $5.

This textbook represents a 10-year development of lectures and classroom discussions given by the author. Since the preparation of the original edition two revisions have been made, the last dated March, 1926, bringing the material fully up to date. It is designed as a general textbook for undergraduates and as such has had about twenty years successful use. The material dealt with is limited largely to fundamentals, with a few illustrations of their application to practical problems.

Pains have been taken by the author to explain the relations between the factors involved and to express the physical facts in mathematical forms in such a manner that the student may understand the equations and their rational application. Graphical diagrams are used extensively and a few typical problems are given.

Topics are arranged in a sequence that is advantageous to the student. Elemental principles are developed and then applied successively to the simpler and the more intricate machinery and equipment. Discussions of transmission lines occupy about ten per cent of the content of the book. The concluding chapter constitutes a rather complete introduction to the study of the long-distance transmission line.

PRACTICAL RADIO

By James A. Moyer, S.B., A.M. Director of University Extension, Massachusetts Department of Education; and John F. Wostrel, Instructor in Radio and in charge of Industrial Subjects, Division of University Extension, Massachusetts Department of Education. Second edition, 1926. 271 pages, 182 illustrations, 5¼ x 7½ in., cloth bound. McGraw-Hill Book Company, Inc., New York. $1.75.

This book constitutes a useful contribution to the quantity of works published upon radio and allied subjects. The first few chapters are given over largely to a discussion of some of the more important fundamentals involved in the consideration of radio equipment and its application. Mathematics has been avoided by the authors in order to make the book more widely useful.

Descriptions of various types of sets are given beginning with the most simple crystal sets and progressing through the more complicated vacuum-tube sets. A chapter is devoted to a discussion of radio-frequency amplification and another to audio-frequency amplification, both being subjects not too clearly understood by the average practical radio man. Chapters also are devoted to the subjects of construction of radio sets and of common troubles and their location.

The book is up-to-date and, while naturally containing no particular revelations, should be a handy and valuable reference book for the practical radio fan, or for purposes of instruction within its limits.

Personals

Herbert S. Sands, manager of the industrial division, Westinghouse Electric & Manufacturing Company, Denver, has been signally honored in that he has received from the University of Colorado the degree of electrical engineer although he is not a university man. The subject of Mr. Sands' thesis was "The Electrical Engineer in Industry." Never before in its history

HERBERT S. SANDS

has the University of Colorado conferred a master's degree upon any engineer who had not previously attended some institution of higher education. Mr. Sands is an outstanding figure in Colorado engineering and other scientific fields. He always has taken a leading part in the educational and public relations activities of the public utilities of the state. He was born in Stamford, Conn., in 1874, and received a common school education, after which he completed a student course of the Edison General Electric Company. After a few years of practical experience and study his qualifications as an engineer were recognized, and in 1893 he was appointed superintendent of the Baltic Power Company, operating in the Cripple Creek mining district, Colorado. Later he became associated in a supervisory and consulting capacity with some of the largest mining companies in the Cripple Creek and Idaho Springs regions. In 1901 he was summoned by the Westinghouse company to take charge of its industrial division. At the present time Mr. Sands is president of the Colorado State Board of Engineers' Examiners and of the Colorado Engineers' Council. Since 1905 he has been district vice-president of the American Institute of Electrical Engineers. He was president of the Colorado Scientific Society in 1923 and 1924. He is a member of the Denver Chamber of Commerce and various other Denver civic organizations. As chairman of the educational department of the Rocky Mountain Committee on Public Utility Information, which embraces the three states of Colorado, New Mexico and Wyoming, Mr. Sands has been responsible for the introduction of public-utility courses, lectures and studies in virtually every university and college. Recently the University of Colorado inaugurated a correspondence course covering the economics of the utility industry, based upon plans worked out in conjunction with Mr. Sands' committee. The high schools of Denver this fall will take up a course of study provided by Mr. Sands' organization.

C. G. Stoll, general manager of manufacture, Western Electric Company, New York, has been elected a vice-president to succeed the late **H. F. Albright.** Mr. Stoll formerly was manager of the company's Hawthorne Works in Chicago.

Edward Dean Adams of New York recently was presented formally with the John Fritz Medal awarded for the year 1926 by Engineering Foundation to him "for great achievements as engineer, financier, scientist, whose vision, courage and industry made possible the birth at Niagara Falls of hydroelectric power." The medal, established in 1902 in honor of John Fritz of Pittsburgh, is awarded annually for notable scientific or industrial achievement.

R. D. Hightshoe, formerly associated with the Mine & Smelter Supply Company, Denver, is now a member of the city sales staff of the Graybar Electric Company.

B. C. Watts, of B. C. Watts & Company, Denver, has been making a visit in California where he expects to spend a month or six weeks.

R. W. Lawlor, formerly cashier for the Bend Water, Light & Power Company, Bend, Ore., has been transferred to the treasury department of the Pacific Power & Light Company, Portland, in charge of keeping the general books of the newly organized Deschutes Power Company, another Electric Bond & Share Company holding.

E. C. Headrick, of Denver, executive committeeman, Mountain States Division, A.E.I. has left for Cedar Point, Ohio, to attend the annual convention of the association in that city. Mr. Headrick is past chairman of the Electrical League of Colorado and as an advisory board member has been delegated to represent that organization at the National League Council and Camp Co-operation VI to be held at Association Island following the Electragists' convention.

Raymond L. Brown, engineer for The New Departure Manufacturing Company, Bristol, Conn., recently spent a short time in San Francisco en route to the Northwest.

Homer W. Eddy, sales manager of the Riegos y Fuersa del Ebro S. A. C. Barcelonesa de Electricidad, Barcelona, Spain, visited Spokane for a few days in July. Mr. Eddy was formerly an employee of The Washington Water Power Company.

R. P. Bayne, formerly cedar pole service manager for the Weyerhaeuser Sales Company, Spokane, has been made manager cedar pole sales for that company, succeeding **F. H. Burke,** who has been appointed manager of its Chicago district.

Frank J. McEniry, who has been head of the publicity department of KOA, the General Electric Company's radio station in Denver, has resigned to enter the newspaper field on the Pacific Coast. **Miss Margaret L. Bonar,** widely known in Denver newspaper and advertising circles, will succeed Mr. McEniry.

Preston B. Postlethwaite, since 1923 vice-president of the Wagner Electric Corporation, St. Louis, has been elected president, succeeding **Waldo A. Layman,** resigned. Mr. Postlethwaite has been connected with the corporation for seventeen years, having entered its employ as an apprentice at 15 cents an hour.

F. L. Rohrbach, superintendent of underground department, Washington Water Power Company, Spokane, has been issued a patent on a device for protecting underground lead cable from injurious wear at the duct end. Mr. Rohrbach recently was appointed member at large on the underground systems committee, Engineering National Section, N.E.L.A.

Don Grey, for the past two years employed as a salesman for the Westinghouse Electric & Manufacturing Company in its Klamath Falls, Ore., territory, has been transferred to the industrial division of the San Francisco office. He succeeds **Gano R. Baker,** who recently resigned to become sales engineer for the Spencer Elevator Company in that city. Prior to his transfer to the Pacific Coast Mr. Grey was connected with the company's sales department in East Pittsburgh for several years.

D. L. Huntington, president, The Washington Water Power Company, Spokane, recently made a trip East. He was expected to return about Sept. 1.

Dr. W. D. Coolidge, assistant director of the research laboratory of the General Electric Company and inventor of an X-Ray tube which bears his name and is used universally in hospitals and laboratories, has been awarded the Howard N. Potts gold medal for 1926 by the Franklin Institute of Philadelphia. The medal was awarded "in consideration of the originality and ingenuity shown in the development of a vacuum tube that has simplified and revolutionized the production of X-Rays."

Dr. George Otis Smith, director of the United States Geological Survey, was in Salt Lake City for several days during the early part of August. While in that section he attended the Uintah Basin industrial convention held at Fort Duchesne, Utah, where he delivered an address, as the personal representative of Hubert Work, Secretary of the Interior, on the subject "The Interest of the Interior Department in Utah." Dr. Smith has been making a tour of the West, conferring with survey officials of the various states.

Edward H. Sniffin, assistant to vice-president of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, was a visitor in San Francisco for several days during August. He is one of the three men who were directly responsible for the general use of the steam turbine in the United States. The other two were George Westinghouse and Francis Hodgkinson, engineer and turbine designer.

Dr. Harris J. Ryan, head of the department of electrical engineering at Stanford University, is to be presented with the Edison Medal at the A.I.E.E. convention to be held in Salt Lake City in September. Dr. Ryan was awarded the medal for the year 1925.

Harry S. Schott, for the past two years assistant general sales manager for the National Carbon Company, Inc., New York City, has been appointed general sales manager.

C. E. Schnell, of the San Joaquin Light & Power Corporation, Fresno, paid a visit to the Exchequer plant of the Merced Irrigation District recently.

Frank E. Cronan, Pacific Coast representative, George W. Dunham Corporation, Utica, N. Y., has left for a business trip in the Northwest territory, principally around Portland, Ore.

Prof. G. G. Ponti, noted engineer of Turin, Italy, recently inspected the Pacific Gas and Electric Company's load-dispatching station at Oakland and the Vaca-Dixon substation. Professor Ponti came to America to gather data to support his recommendation for a 200-kv. transmission line in Italy.

M. N. Farr, Western sales manager, Howell Electric Motors Company, Howell, Mich., was a recent Pacific Coast visitor. He spent some time in Vancouver, Seattle, Portland and San Francisco.

H. H. Rogge, who has been connected with the general engineering department of the New York sales office of the Westinghouse Electric & Manufacturing Company, has been appointed that company's special representative to the Philippine Islands. His territory also will include the Dutch East Indies, the Malay Peninsula and Siam.

Robert M. Davis, since 1919 statistical editor of the Electrical World, has been made statistical adviser of the McGraw-Hill publications. Prior to joining the staff of the Electrical World Mr. Davis was connected with the U. S. Geological Survey for several years.

Arthur T. Hadley, former president of Yale University, recently spent some time in San Francisco. While there he served as an important witness for the Pacific Gas and Electric Company in the hearing before the California Railroad Commission relative to the evalution of that company's system in San Francisco.

Walter S. Jennens, associated with the Utah Power & Light Company, Salt Lake City, and its predecessors over a period of twenty-eight years, has resigned to accept a position as electrical engineer with the Ohio Brass Company, with headquarters at Barberton, Ohio. Mr. Jennens was in charge of high-tension construction work at the time of his resignation.

J. O. Presbrey, Pacific Coast sales manager, Ivanhoe Division of The Miller Company, Cleveland, has returned to Los Angeles from a two-months' trip to Panama and Havana. Mr. Presbrey also visited the company's factories at Meriden, Conn.

C. P. Kinkaid has been appointed distribution superintendent of the Valley Division, Central District, Puget Sound Power & Light Company, Seattle. He succeeds **C. S. Noble** who has resigned to accept a position with the Tampa Electric Company.

S. D. H. Pope, formerly connected with the electrical engineering department of the British Columbia Electric Railway Company, Ltd., Vancouver, B. C., has become assistant engineer for the municipality of South Vancouver.

F. E. Weymouth has severed his connection with Brock & Weymouth, Inc., as active head, although he remains a director and consultant of the company, and has been engaged by the J. G. White Engineering Corporation as chief engineer for work in Mexico.

Ladner V. Ross, formerly connected with Curtis Lighting, Inc., Chicago, has been appointed illuminating engineer for The Washington Water Power Company, Spokane.

A. B. Vandercook, who has been sales manager of the Graybar Electric Company, has been made assistant manager of the Los Angeles branch. **H. T. Simmons,** assistant sales manager under Mr. Vandercook, has been named as his successor.

R. M. Alvord, district manager for the General Electric Company in San Francisco, recently returned from a trip to the company's plant in Schenectady, N. Y.

P. H. Booth, Edison Electric Appliance Company, Los Angeles, stopped in San Francisco a short while ago en route to Alaska.

H. H. Jones, vice-president and general manager, Western States Gas & Electric Company, Stockton, Calif., recently paid a brief visit to San Francisco.

C. B. Angenete, president and general manager of the Domestic Appliance Company, Inc., Oakland, Calif., recently has returned from a trip to the factory of The Meadows Manufacturing Company, Bloomington, Ill.

W. L. Kirkman, formerly a load dispatcher at Pasco, Wash., for the Pacific Power & Light Company, has returned to his former position after having spent two years studying electrical engineering at Purdue University, from which he has received his degree.

Dr. Robert A. Millikan, since 1921 executive head of the California Institute of Technology, Pasadena, has had conferred upon him the A.S.M.E. medal. Dr. Millikan, whose most noteworthy work probably is that in connection with his research into the nature of the electron, also has been the recipient of the Edison medal of the A.I.E.E., the Hughes medal of the Royal Society of Great Britain, the Nobel prize of the Swedish Academy and the Faraday medal of the London Chemical Society.

E. E. Scofield, industrial engineer of The Washington Water Power Company, Spokane, recently attended the N.E.L.A. industrial electric heating course held in Mansfield, Ohio.

C. M. McIntosh, Denver representative of the MacBeth-Evans Glass Company, lately made a trip to El Paso.

R. H. Manahan, city electrician of Los Angeles, made a business trip to San Francisco a short time ago.

W. L. Barbee has been appointed distribution engineer of the central district of the Puget Sound Power & Light Company, Seattle, filling the vacancy caused by the resignation of **D. R. Nankervis.**

Frank N. Smith, formerly with the Pacific Gas and Electric Company, San Francisco, and previous to that southern district representative for the California Electrical Bureau, is now manager of the educational department for Pathe Exchange, Los Angeles. For years Mr. Smith has been a personal friend of Roald Amundsen, the Arctic explorer, and recently delivered before members of the San Francisco Electrical Development League a most interesting address on the Amundsen-Ellsworth polar flight.

W. R. Matthews, district salesman for The Miller Lamp Company, recently spent three days in Spokane.

Franklin S. Terry, one of the notable men in the electrical field, died suddenly July 22 at his country home, Black Mountain, N. C. He was a pioneer in the incandescent lamp industry and his activities had much to do with the promotion and progress of electric lighting. He was born in Ansonia, Conn., in 1862, was graduated from the Ansonia High School in 1880 and then began his active business career as a bookkeeper with The Electrical Supply Company of Ansonia. In 1889 he had organized the Sunbeam Incandescent Lamp Company of Chicago, and when he left the Electrical Supply Company in 1893 he took personal management of the lamp business which, under his direction, progressed steadily. He directed his energies toward improvement of the product and made his company one of the leaders in the lamp business, conducting it until May, 1901, when the Sunbeam company was purchased by the National Electric Lamp Company. He engaged with the company, first as secretary and later as first vice-president. In 1911 the company was merged with the General Electric Company. Then Mr. Terry continued with the National Lamp Works of the General Electric Company, at Nela Park, Cleveland, of which he and B. G. Tremaine were the managers. At the time of his death he was vice-president of the General Electric Company and also a director of the Cities Service Company. He was one of the organizers of the National Electric Light Association when that body was founded in February, 1885, at Chicago. For many years he had served on the association's incandescent lamp committee.

FRANKLIN S. TERRY

Charles D. Jenney, a pioneer in the development of direct-current motors and systems of electrical control, died recently in Indianapolis. Mr. Jenney was one of the first manufacturers to employ carbon brushes on motors and also one of the first to build small 500-volt direct-current motors, a field in which he was pre-eminent at the time.

George H. Eveland, electrical engineer in charge of power-house layout design for the Feather River Power Company, San Francisco, died Aug. 19 of pneumonia.

R. B. Childs of the commercial department of The Washington Water Power Company, Spokane, spent two weeks in military training at Fort Wright in that city, after which he visited for several days in Seattle.

TRADE NOTES

Bakelite Corporation, New York City, has issued a new folder illustrative of the uses of its product, which it is claimed supersedes amber, celluloid, fibre, gallalith, glass, horn, ivory, jet, metal, paper, porcelain, rawhide, hard rubber, shellac, vegetable ivory and wood. The commercial forms of Bakelite include Bakelite molder, Bakelite laminated, Bakelite transparent, Bakelite varnishes, lacquers, enamels and cements.

Wyatt's Lighting Fixtures, 1810 Westlake Avenue, Seattle, manufacturers of specially designed lighting fixtures, recently has been established by **N. D. Wyatt.** He was formerly connected with Bailey, Wyatt & Lynde.

George Richards & Company, Chicago, have placed on the market recently another type of steel-encased bell-ringing transformer designed for residences and small apartments. It is mounted on a round outlet box cover and can be furnished mounted on either a 3¼-in. or 4-in. cover. The company claims that this type of transformer is of a decided advantage in that the transformer is grounded and attached to the outlet box so that a drop-cord may be run from the same box.

The Couzens Ice Machine Company has removed its sales headquarters from Lima, Ohio, to Detroit, and increased scope of its operations and the rapid maturing of plans developed durthe past nine months are anticipated developments following the removal, according to a statement by the company. Definite policies have been adopted in conference between Senator Couzens and other executives of the company, based on the experience gained through the operation of the Superior Division which took over Superior Refrigeration, Inc., several months ago.

Electric Steam Heating Company, 4711 Ballard Avenue, Seattle, has placed on the market the Perfection combination waffle plate and grill. It has an aluminum grid and an expansion hinge that allows the waffle to raise evenly both front and back while cooking. It also allows for removal of the top and placing in position for cooking on both top and bottom. The heating element is made from the very best material obtainable, it is claimed, and is used in a nest made by the company's own secret process, thus insuring an even distribution of all heat to the grid.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, has issued Registers of Revenue, a publication dealing with the description of the advantages of the design of watthour meters. The permanent accuracy of the watthour meter, low costs of adjustments and tests, low costs of handling, ease in reading and saving of storage space are some of the points covered in this circular, C-1753. This publication may be obtained from any of the district offices of the Westinghouse company or from the publicity department at East Pittsburgh.

Edison Electric Appliance Company, Inc., Chicago, has purchased a six-story fireproof building at 1910-28 S. 52d Avenue, in that city, to take care of its rapidly increasing business. This is due to the popularity of household electric appliances and hotel and restaurant cooking equipment, of which the company claims to be the largest manufacturer in the world.

The Edwin F. Guth Company, St. Louis, has issued a folder descriptive and illustrative of the Guthlite Super-Illuminator. It is made in an attractive design, controls and directs light and is suitable for any kind of ceiling, high or low, light or dark, beamed or plain, according to the manufacturer. Sizes and price lists are included in the folder.

The Ludlum Steel Company, Watervliet, N. Y., is planning to change over the remainder of its melting furnaces from manual to automatic electric control. This company uses electric furnaces of its own patented design, featuring a movable hearth with a consequent increase in production per furnace.

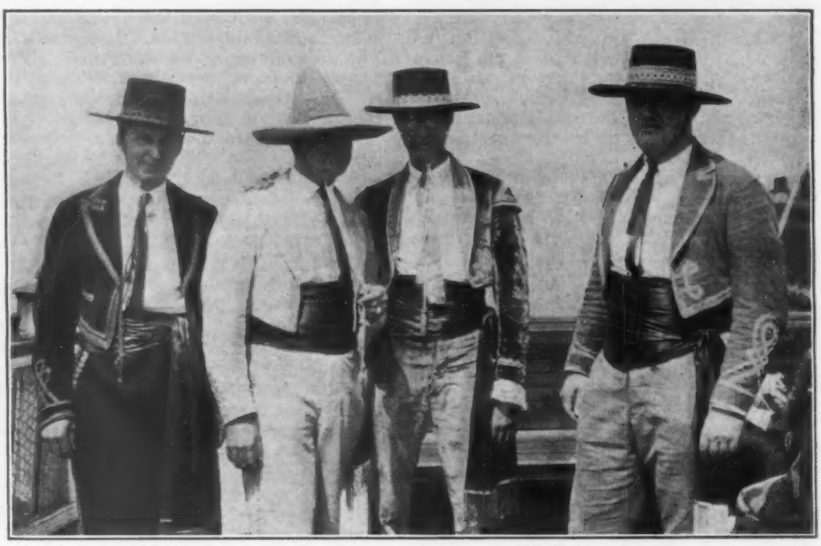
The Leonard Refrigerator Company, Grand Rapids, Mich., has announced its purpose to concentrate production on styles and sizes of refrigerators which have proved themselves best sellers in the market. The new Leonard Cleanable models, built extra strong and with extra-thick insulation, are offered by the makers as ideal for use with electrical refrigeration. They are equipped for convenient installation of the electrical unit.

Harold E. Trent, Philadelphia, has added a new melting pot to its line. This pot is suitable for melting babbit, solder, lead and tin and has a capacity of 10 lb. It is adapted for 110 and 220 volts a.c. and can be connected to a lamp socket. It is fitted with spouts and two handles to facilitate pouring metal if so desired.

Roller-Smith Company, New York City, has issued bulletin No. 810 covering its radio frequency ammeters, milli-ammeters, and current squared meters. Type TW and type FW ammeters are recent devices put out by the company, and complete descriptions with price lists are given in the bulletin.

Trumbull-Vanderpoel Electric Manufacturing Company, manufacturer of "T-V" safety switches and knife switches, recently held a sales conference at its home office in Bantam, Conn., that was attended by representatives from all over the country. During the conference **Ralph K. Mason,** who has been president of the company for a number of years, announced his retirement from the firm, and in appreciation of his long and valuable services the sales force presented him with a watch and chain. **Harmon J. Cook** is the new president, **John H. Lancaster,** vice-president and general counsel, and **James N. Miller,** secretary and treasurer.

A. E. Bacon, manufacturers' agent, formerly associated with the Mine & Smelter Supply Company, Denver, recently returned from a trip East after having completed negotiations with several manufacturers enabling him to act as their district representative with headquarters in Denver. Among the accounts are included **Benjamin Electric Company, American Pipe Bending Machine Company, Autovent Fan and Blower Company, McGill Manufacturing Company, Autocall Company,** and **National Metal Molding Company.**



Four gentlemen from Spain off to a fandango to whisper sweet nothings in the ears of pretty senoritas? Not at all. Four gentlemen from Los Angeles off to Nela Park, Cleveland, to attend the Mazda sales conference. Then how come the scenery? Patience, my children. These caballeros are the winners of the Graybar Electric Company's "On to Nela" contest wherein each sales contract counted for so many miles, each advertising service sold counted for so many miles, and he who accumulated 10,000 miles was It. Each of our Spanish friends ran considerably over that total so they took the little jaunt. Being from Los Angeles, they just couldn't resist dressing in the costume of the days "before the Gringo came" just to show how different it is now. They even started their travels in "The Padre" and—subtle touch—they distributed oranges on the way just to adv—er—emphasize the section whence they came. Left to right the senores are—Jim Loomer, Roy Lockhart, Leon Collins and P. Chambers.